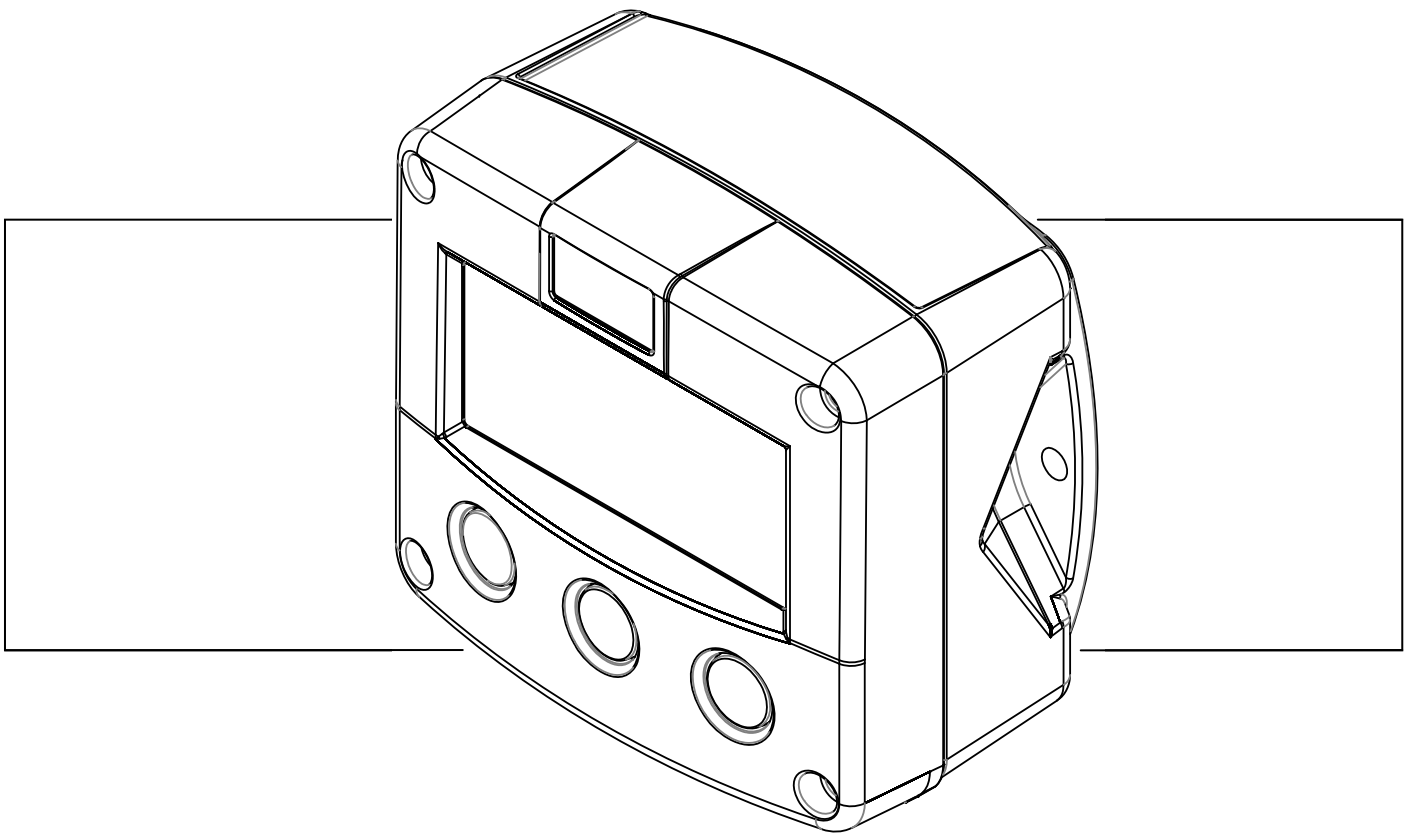


# *F111-A*

*DUAL FLOWRATE INDICATOR / TOTALIZER*



*Signal input flowmeters: (0)4-20mA*

*Signal outputs: two scaled pulse outputs reflecting total*

*Options: Intrinsically Safe, Modbus communication*



## SAFETY INSTRUCTIONS



- Any responsibility is lapsed if the instructions and procedures as described in this manual are not followed.
- **LIFE SUPPORT APPLICATIONS:** The F111-A is not designed for use in life support appliances, devices, or systems where malfunction of the product can reasonably be expected to result in a personal injury. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify the manufacturer and supplier for any damages resulting from such improper use or sale.
- **Electro static discharge does inflict irreparable damage to electronics! Before installing or opening the unit, the installer has to discharge himself by touching a well-grounded object.**
- This unit must be installed in accordance with the EMC guidelines (Electro Magnetic Compatibility).
- Do connect a proper grounding to the aluminum casing as indicated if the F111-A has been supplied with the 115-230V AC power-supply type PM. The green / yellow wire between the back-casing and removable terminal-block may never be removed.
- **Intrinsically Safe applications: follow the instructions as mentioned in Chapter 5 and consult “Fluidwell F1...-XI - Documentation for Intrinsic Safety”.**

## DISPOSAL



At the end of its life this product should be disposed of according to local regulations regarding waste electronic equipment. If a battery is present in this product it should be disposed of separately. The separate collection and recycling of your waste equipment will help to conserve natural resources and ensure that it is recycled in a manner that protects the environment.

## SAFETY RULES AND PRECAUTIONARY MEASURES

- The manufacturer accepts no responsibility whatsoever if the following safety rules and precautions instructions and the procedures as described in this manual are not followed.
- Modifications of the F111-A implemented without preceding written consent from the manufacturer, will result in the immediate termination of product liability and warranty period.
- Installation, use, maintenance and servicing of this equipment must be carried out by authorized technicians.
- Check the mains voltage and information on the manufacturer's plate before installing the unit.
- Check all connections, settings and technical specifications of the various peripheral devices with the F111-A supplied.
- Open the casing only if all leads are free of potential.
- Never touch the electronic components (ESD sensitivity).
- Never expose the system to heavier conditions than allowed according to the casing classification (see manufacture's plate and chapter 4.2.).
- If the operator detects errors or dangers, or disagrees with the safety precautions taken, then inform the owner or principal responsible.
- The local labor and safety laws and regulations must be adhered to.

## ABOUT THE OPERATION MANUAL

This operation manual is divided into two main sections:

- The daily use of the unit is described in chapter 2 "Operation". These instructions are meant for users.
- The following chapters and appendices are exclusively meant for electricians/technicians. These provide a detailed description of all software settings and hardware installation guidance.

This operation manual describes the standard unit as well as most of the options available. For additional information, please contact your supplier.

**A hazardous situation may occur if the F111-A is not used for the purpose it was designed for or is used incorrectly. Please carefully note the information in this operating manual indicated by the pictograms:**



A "**warning**" indicates actions or procedures which, if not performed correctly, may lead to personal injury, a safety hazard or damage of the F111-A or connected instruments.



Caution !

A "**caution**" indicates actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the F111-A or connected instruments.



Note !

A "**note**" indicates actions or procedures which, if not performed correctly, may indirectly affect operation or may lead to an instrument response which is not planned.

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Software version	:	02.04.xx
Manual	:	HF111AEN_v0501_05
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**Information in this manual is subject to change without prior notice. The manufacturer is not responsible for mistakes in this material or for incidental damage caused as a direct or indirect result of the delivery, performance or use of this material.**

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# 1. INTRODUCTION

## 1.1. SYSTEM DESCRIPTION OF THE F111-A

### Functions and features

The dual flowrate / totalizer model F111-A is a microprocessor driven instrument designed to display flowrate, total and accumulated total of two completely separated flow measurement systems.

This product has been designed with a focus on:

- ultra-low power consumption to allow long-life battery powered applications (type PB / PC),
- intrinsic safety for use in hazardous applications (type XI),
- several mounting possibilities with aluminum or GRP enclosures for harsh industrial surroundings,
- ability to process all types of flowmeter signals,
- transmitting possibilities with pulse and communication (option) outputs.

### Flowmeter input

This manual describes the unit with a (0)4-20mA type input from the flowmeter "-A version". Other versions are available to process pulse or 0-10V flowmeter signals.

Two flowmeters with a passive or active (0)4-20mA signal output can be connected to the F111-A. To power the sensors, several options are available.

### Standard outputs

- For each flowmeter input, one configurable pulse output: a scaled pulse mirroring a certain totalized quantity. Maximum frequency 60Hz.; the pulse length can be set from 7,8msec up to 2 seconds.

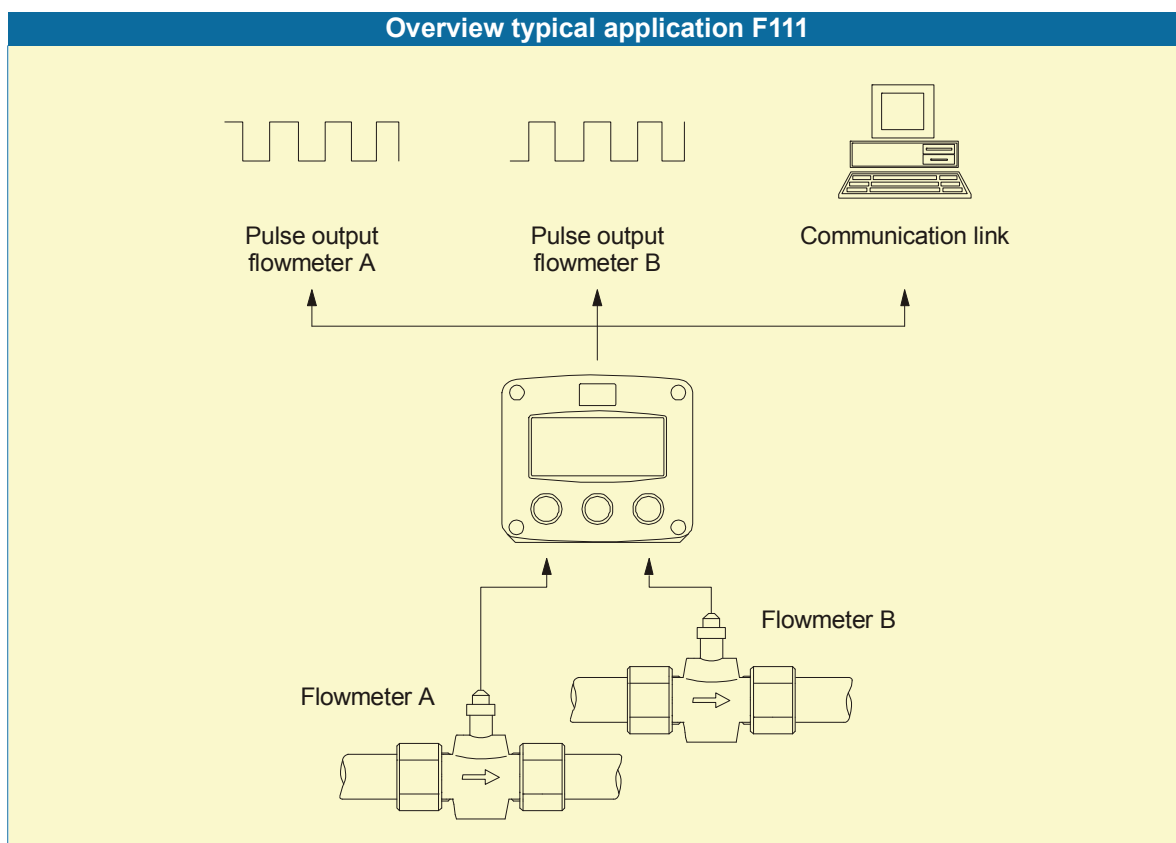


Fig. 1: Typical application for the F111-A

### **Configuration of the unit**

The F111-A was designed to be implemented in many types of applications. For that reason, a SETUP-level is available to configure your F111-A according to your specific requirements. SETUP includes several important features, such as Span, measurement units, signal selection etc. All settings are stored in EEPROM memory and will not be lost in the event of power failure or a drained battery.

To extend the battery-life time (option), please make use of the power-management functions as described in chapter 3.2.3.

### **Display information**

The unit has a large transfective LCD with all kinds of symbols and digits to display measuring units, status information, trend-indication and key-word messages.

Flowrate and totals of each flow can be displayed either with the small 8mm digits or with the 17mm digits. A toggle function is available to show the information of each flow automatically during 6 seconds. A backup of the totals and accumulated totals in EEPROM memory is made every minute.

### **Options**

The following options are available: full Modbus communication RS232/485 (also battery powered), intrinsic safety, mechanical relay or active outputs, power- and sensor-supply options, panel-mount, wall-mount and weather-proof enclosures, flame proof enclosure.

## 2. OPERATIONAL

### 2.1. GENERAL



- The F111-A may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.
- Take careful notice of the " Safety rules, instructions and precautionary measures " in the front of this manual.

This chapter describes the daily use of the F111-A. This instruction is meant for users / operators.

### 2.2. CONTROL PANEL

The following keys are available:

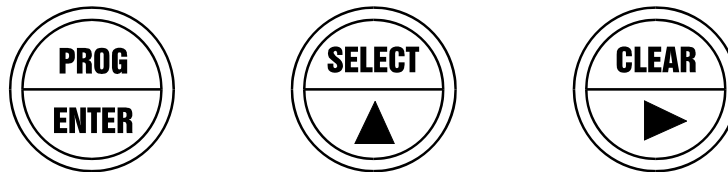


Fig. 2: Control Panel

#### Functions of the keys



This key is used to program and save new values or settings.  
It is also used to gain access to SETUP-level; please read chapter 3.



This key is used to SELECT the information of each flow by hand.  
The arrow-key ▲ is used to increase a value after PROG has been pressed or to configure the unit; please read chapter 3.



After total has been selected, press this key twice to CLEAR the value for total.  
The arrow-key ► is used to select a digit after PROG has been pressed or to configure the unit; please read chapter 3.

### 2.3. OPERATOR INFORMATION AND FUNCTIONS

In general, the F111-A will always function at Operator level. The information displayed is dependant upon the SETUP-settings. All pulses generated by the connected flowmeters are measured by the F111-A in the background, whichever screen refresh rate setting is chosen. After pressing a key, the display will be updated very quickly during a 30 second period, after which it will slow-down again.

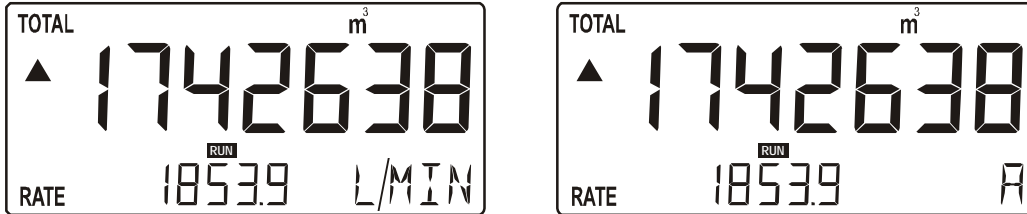


Fig. 3: Example of display information during process

For the Operator, the following functions are available:

- **Display flowrate / total or flowrate**  
For each flow, total is displayed on the upper-line of the display and flowrate on the bottom line. Also the information "flow A" or "flow B" will be displayed.  
It is possible to display flowrate only with the large 17mm digits; in this instance press the SELECT-key to read the total.  
When "-----" is shown, then the flowrate value is too high to be displayed. The arrows  $\blacklozenge$  indicate the increase/decrease of the flowrate trend.  
If activated, all information will be displayed step by step with the automatic toggle function; else you have to select the information manually.
- **Clear total**  
The value for total can be re-initialized. To do so, select the desired total and press CLEAR twice. After pressing CLEAR once, the flashing text "PUSH CLEAR" is displayed. To avoid re-initialization at this stage, press another key than CLEAR or wait for 20 seconds.  
Re-initialization of total DOES NOT influence the accumulated total.
- **Display accumulated total**  
If this function is activated, accumulated Total will be displayed after pressing the SELECT-key a few times. The accumulated total cannot be re-initialized. The value will count up to 99,999,999,999. The unit and number of decimals are displayed according to the configuration settings for total.
- **Low-battery alarm**  
When the battery voltage drops, it must be replaced. At first "low-battery" will flash, but as soon as it is displayed continuously, the battery MUST be replaced shortly after!  
Only original batteries supplied by the manufacturer may be used, else the guarantee and liability will be terminated. The remaining lifetime after the first moment of indication is generally several days up to some weeks.



Fig. 4: Example of low-battery alarm

- **Alarm 01-03**  
When "alarm" is displayed, please consult Appendix B: problem solving.



### 3. CONFIGURATION

#### 3.1. INTRODUCTION

This and the following chapters are exclusively meant for electricians and non-operators. In these, an extensive description of all software settings and hardware connections are provided.



Caution !

- Mounting, electrical installation, start-up and maintenance of the instrument may only be carried out by trained personnel authorized by the operator of the facility. Personnel must read and understand this Operating Manual before carrying out its instructions.
- The F111-A may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.
- Ensure that the measuring system is correctly wired up according to the wiring diagrams. The housing may only be opened by trained personnel.
- Take careful notice of the " Safety rules, instructions and precautionary measures " in the front of this manual.

#### 3.2. PROGRAMMING SETUP-LEVEL

##### 3.2.1. GENERAL

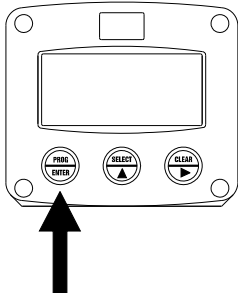
Configuration of the F111-A is done at SETUP-level. SETUP-level is reached by pressing the PROG/ENTER key for 7 seconds; at which time, both arrows ⇄ will be displayed. In order to return to the operator level, PROG will have to be pressed for three seconds. Alternatively, if no keys are pressed for 2 minutes, the unit will exit SETUP automatically. SETUP can be reached at all times while the F111-A remains fully operational.




Note !

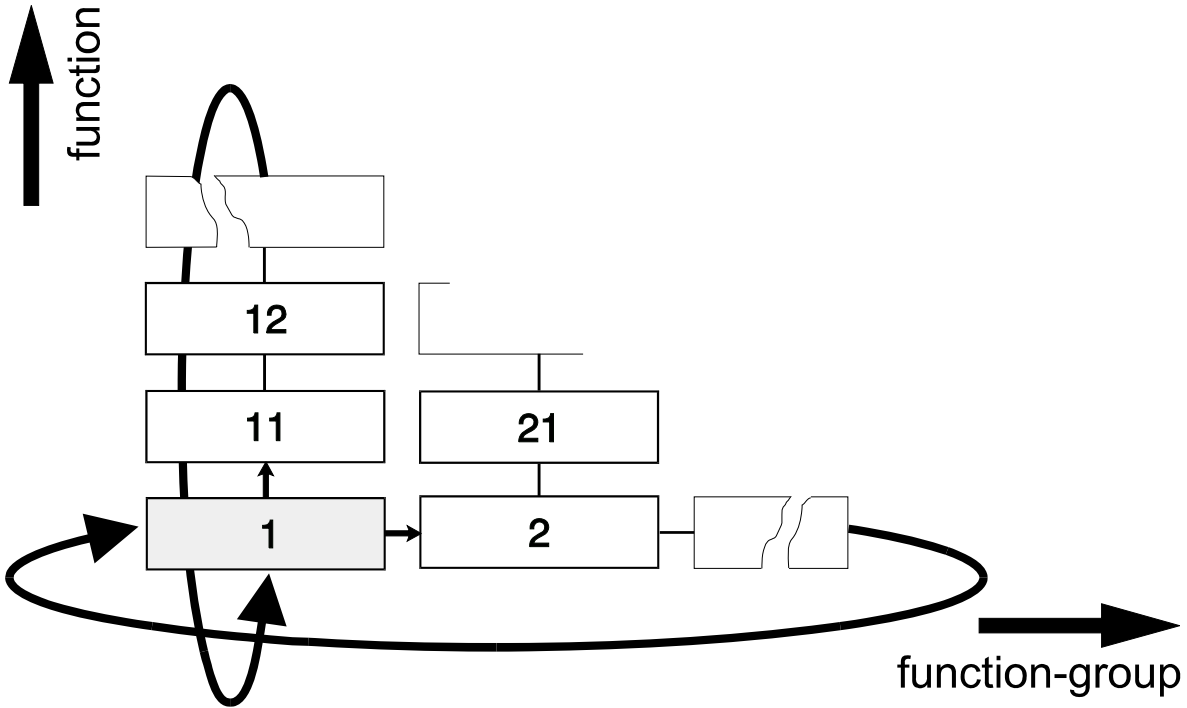
**Note:** A pass code may be required to enter SETUP. Without this pass code access to SETUP is denied.

To enter SETUP-level:



Press  for 7 seconds

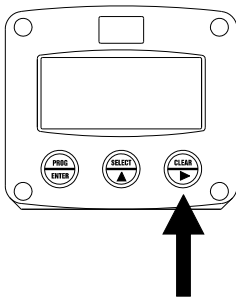
**Matrix structure SETUP-level:**



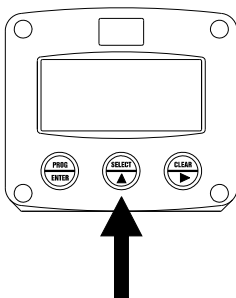
**SCROLLING THROUGH SETUP-LEVEL**

**Selection of function-group and function:**

SETUP is divided into several function groups and functions.



Select function-group with



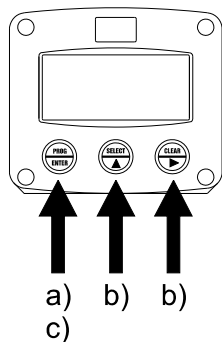
Select function with





Each function has a unique number, which is displayed below the word "SETUP" at the bottom of the display. The number is a combination of two figures. The first figure indicates the function-group and the second figure the sub-function. Additionally, each function is expressed with a keyword.

After selecting a sub-function, the next main function is selected by scrolling through all "active" sub-functions (e.g. 1<sup>▲</sup>, 11<sup>▲</sup>, 12<sup>▲</sup>, 13<sup>▲</sup>, 14<sup>▲</sup>, 1<sup>▶</sup>, 2<sup>▶</sup>, 3<sup>▲</sup>, 31 etc.).


To change or select a value:







a) press  briefly; **PROGRAM** will start flash

b) select or enter value with  and / or 

c) press  to confirm the value / selection.

To change a value, use  to select the digits and  to increase that value.

To select a setting, both  and  can be used.

If the new value is invalid, the increase sign  or decrease-sign  will be displayed while you are programming.

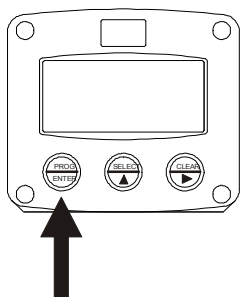
When data is altered but ENTER is not pressed, then the alteration can still be cancelled by waiting for 20 seconds or by pressing ENTER for three seconds: the PROG-procedure will be left automatically and the former value reinstated.



Note !

**Note:** alterations will only be set after ENTER has been pressed!

To return to OPERATOR-level:



Press  for 3 seconds

In order to return to the operator level, PROG will have to be pressed for three seconds. Also, when no keys are pressed for 2 minutes, SETUP will be left automatically.

## 3.2.2. OVERVIEW FUNCTIONS SETUP LEVEL

<b>SETUP FUNCTIONS AND VARIABLES</b>			
<b>1</b>	<b>TOTAL A</b>		
	11	UNIT	L - m3 - kg - lb - GAL - USGAL - bbl - no unit
	12	DECIMALS	0 - 1 - 2 - 3 (Ref: displayed value)
	13	SPAN	0.000001 - 999,999 unit/second
	14	DECIMALS SPAN	0 - 6
<b>2</b>	<b>FLOWRATE A</b>		
	21	UNIT	mL - L - m3 - mg - g - kg - ton - GAL - bbl - lb - cf - REV - no unit - scf - Nm3 - NL - P
	22	TIME UNIT	sec - min - hour - day
	23	DECIMALS	0 - 1 - 2 - 3 (Ref: displayed value)
	24	SPAN	0.000001 - 999,999 unit/time-unit
	25	DECIMALS SPAN	0 - 6
<b>3</b>	<b>TOTAL B</b>		
	31	UNIT	L - m3 - kg - lb - GAL - USGAL - bbl - no unit
	32	DECIMALS	0 - 1 - 2 - 3 (Ref: displayed value)
	33	SPAN	0.000001 - 999,999 unit/second
	34	DECIMALS SPAN	0 - 6
<b>4</b>	<b>FLOWRATE B</b>		
	41	UNIT	mL - L - m3 - mg - g - kg - ton - GAL - bbl - lb - cf - REV - no unit - scf - Nm3 - NL - P
	42	TIME UNIT	sec - min - hour - day
	43	DECIMALS	0 - 1 - 2 - 3 (Ref: displayed value)
	44	SPAN	0.000001 - 999,999 unit/time-unit
	45	DECIMALS SPAN	0 - 6
<b>5</b>	<b>DISPLAY</b>		
	51	FUNCTION	total - flowrate
	52	DISPLAY	toggle - hand
	53	ACCUMULATED TOTAL	enable - disable
<b>6</b>	<b>POWER MANAGEMENT</b>		
	61	LCD UPDATE	fast - 1 sec - 3 sec - 15 sec - 30 sec - off
	62	BATTERY MODE	operational - shelf
<b>7</b>	<b>SENSOR A</b>		
	71	FORMULA	interpolation, square root
	72	FILTER	00 - 99
	73	CUT-OFF	0.0 - 99.9%
	74	CALIBRATE LOW	(0)4mA
	75	CALIBRATE HIGH	20mA
<b>8</b>	<b>SENSOR B</b>		
	81	FORMULA	interpolation, square root
	82	FILTER	00 - 99
	83	CUT-OFF	0.0 - 99.9%
	84	CALIBRATE LOW	(0)4mA
	85	CALIBRATE HIGH	20mA
<b>9</b>	<b>IMPULSE A</b>		
	91	PERIOD TIME	0 - 250
	92	IMPULSE PER	X,XXX,XXX quantity
<b>A</b>	<b>IMPULSE B</b>		
	A1	PERIOD TIME	0 - 250
	A2	IMPULSE PER	X,XXX,XXX quantity
<b>B</b>	<b>COMMUNICATION</b>		
	B1	SPEED / BAUDRATE	1200 - 2400 - 4800 - 9600
	B2	ADDRESS	1 - 255
	B3	MODE	ASCII - rtu - off
<b>C</b>	<b>OTHERS</b>		
	C1	TYPE / MODEL	
	C2	SOFTWARE VERSION	
	C3	SERIAL NO.	
	B4	PASS CODE	0000 - 9999
	C5	TAGNUMBER	0000000 - 9999999

## 3.2.3. EXPLANATION OF SETUP-FUNCTIONS

1 - TOTAL - A	
<b>MEASUREMENT UNIT 11</b>	<p>SETUP - 11 determines the measurement unit for total, accumulated total and pulse output. The following units can be selected:</p> <p style="text-align: center;">L - m3 - kg - lb. - GAL - USGAL - bbl - _ (no unit).</p> <p>Alteration of the measurement unit will have consequences for operator and SETUP-level values. Please note that the Span has to be adapted as well; the calculation is not done automatically.</p>
<b>DECIMALS 12</b>	<p>The decimal point determines for total, accumulated total and pulse output the number of digits following the decimal point. The following can be selected:</p> <p style="text-align: center;">000000 - 111111.1 - 22222.22 - 3333.333</p>
<b>SPAN 13</b>	<p>With the span, the flowmeter signal is converted to a quantity. The <b>span for Total</b> is determined on the basis of the measurement unit (setting 11) and the <b>flowrate per second</b> at 20mA. Enter the span in whole numbers (decimals are set with SETUP 14). The more accurate the span, the more accurate the functioning of the system will be.</p> <p><b>Example 1: Calculating the span for Total.</b> <i>Let us assume that the flowmeter generates 20mA at a flowrate of 2,481.3 Liters/minute and the selected unit is "cubic meters / m<sup>3</sup>". The rate per second is <math>2,481.3 \div 60</math> is 41.355 L/sec. This is 0.041355 m<sup>3</sup>/sec., which is the span. Enter for SETUP - 13: "041355" and for SETUP - 14 - decimals span "6".</i></p> <p><b>Example 2: Calculating the span for Total</b> <i>Let us assume that the flowmeter generates 20mA at a rate of 652.31 USGAL per hour, the selected unit is barrels. There are 42 gallons in one barrel; so the rate is <math>652.31/42</math> is 15.53119 barrels/hour. This is 0.0043142 barrels/second, which is the span. Enter for SETUP - 13: "004314" and for SETUP - 14 "6".</i></p>
<b>DECIMALS SPAN 14</b>	<p>This setting determines the number of decimals for the Span (SETUP 13). The following can be selected:</p> <p style="text-align: center;">0 - 1 - 2 - 3 - 4 - 5 - 6</p> <p>Please note that this function influences the accuracy of the Span indirectly. This setting has NO influence on the displayed number of digits for total (SETUP 12)!</p>

<b>2 - FLOWRATE - A</b>	
<p>The settings for total and flowrate are entirely separate. In this way, different units of measurement can be used for each e.g. cubic meters for total and liters for flowrate. The display update time for flowrate is one second or more.</p>	
<b>MEASUREMENT UNIT 21</b>	<p>SETUP - 21 determines the measurement unit for flowrate. The following units can be selected:</p> <p style="text-align: center;">mL - L - m3 - mg - g - kg - ton - GAL - bbl - lb - cf - REV - no unit - scf - Nm3 - NL - P.</p> <p>Alteration of the measurement unit will have consequences for operator and SETUP-level values. Please note that the Span has to be adapted as well; the calculation is not done automatically.</p>
<b>TIME UNIT 22</b>	<p>The flowrate can be calculated per second (SEC), minute (MIN), hour (HR) or day (DAY).</p>
<b>DECIMALS 23</b>	<p>This setting determines for flowrate the number of digits following the decimal point. The following can be selected:</p> <p style="text-align: center;">00000 - 1111.1 - 2222.22 - 3333.333</p>
<b>SPAN 24</b>	<p>With the span, the flowmeter signal is converted to a quantity. The <b>span for flowrate</b> is determined on the basis of the <b>selected measurement unit and time unit</b> at 20mA. Enter the span in whole numbers (decimals are set with SETUP 25). The more accurate the span, the more accurate the functioning of the system will be.</p> <p><b>Example 1     Calculating the span for flowrate</b> <i>Let us assume that the flowmeter generates 20mA at a flowrate of 2,481.3 Liters/minute, the selected unit is "Liters" and time unit "minute". The span is 2481.3 Enter for SETUP - 24: "248130" and for SETUP - 25 - decimals span "2".</i></p> <p><b>Example 2     Calculating the span for flowrate</b> <i>Let us assume that the flowmeter generates 20mA at a rate of 652.31 USGAL per hour, the selected unit is USG and the time unit is minute. The span is 652.31 / 60 minutes is 10.87183 (GPM). Enter for SETUP - 24: "108718" and for SETUP - 25 "4".</i></p>
<b>DECIMALS SPAN 25</b>	<p>This setting determines the number of decimals for Span (SETUP 24). The following can be selected:</p> <p style="text-align: center;">0 - 1 - 2 - 3 - 4 - 5 - 6</p> <p>Please note that this SETUP - influences the accuracy of the Span indirectly. This setting has NO influence on the displayed number of digits for "flowrate" (SETUP 23)!</p>

3 - TOTAL - B	
<b>MEASUREMENT UNIT 31</b>	<p>SETUP - 31 determines the measurement unit for total, accumulated total and pulse output. The following units can be selected:</p> <p style="text-align: center;">L - m3 - kg - lb. - GAL - USGAL - bbl - _ (no unit).</p> <p>Alteration of the measurement unit will have consequences for operator and SETUP-level values. Please note that the Span has to be adapted as well; the calculation is not done automatically.</p>
<b>DECIMALS 32</b>	<p>The decimal point determines for total, accumulated total and pulse output the number of digits following the decimal point. The following can be selected:</p> <p style="text-align: center;">000000 - 111111.1 - 2222.22 - 3333.333</p>
<b>SPAN 33</b>	<p>With the span, the flowmeter signal is converted to a quantity. The <b>span for Total</b> is determined on the basis of the measurement unit (setting 31) and the <b>flowrate per second</b> at 20mA. Enter the span in whole numbers (decimals are set with SETUP 34). The more accurate the span, the more accurate the functioning of the system will be.</p> <p><b>Example 1: Calculating the span for Total.</b> <i>Let us assume that the flowmeter generates 20mA at a flowrate of 2,481.3 Liters/minute and the selected unit is "cubic meters / m3". The rate per second is <math>2,481.3 \div 60</math> is 41.355 L/sec. This is 0.041355 m3/sec., which is the span. Enter for SETUP - 33: "041355" and for SETUP - 34 - decimals span "6".</i></p> <p><b>Example 2: Calculating the span for Total</b> <i>Let us assume that the flowmeter generates 20mA at a rate of 652.31 USGAL per hour, the selected unit is barrels. There are 42 gallons in one barrel; so the rate is <math>652.31/42</math> is 15.53119 barrels/hour. This is 0.0043142 barrels/second, which is the span. Enter for SETUP - 33: "004314" and for SETUP - 34 "6".</i></p>
<b>DECIMALS SPAN 34</b>	<p>This setting determines the number of decimals for the Span (SETUP 33). The following can be selected:</p> <p style="text-align: center;">0 - 1 - 2 - 3 - 4 - 5 - 6</p> <p>Please note that this function influences the accuracy of the Span indirectly. This setting has NO influence on the displayed number of digits for total (SETUP 32)!</p>

4 - FLOWRATE - B	
<p>The settings for total and flowrate are entirely separate. In this way, different units of measurement can be used for each e.g. cubic meters for total and liters for flowrate. The display update time for flowrate is one second or more.</p>	
<b>MEASUREMENT UNIT 41</b>	<p>SETUP - 41 determines the measurement unit for flowrate. The following units can be selected:</p> <p style="text-align: center;">mL - L - m3 - mg - g - kg - ton - GAL - bbl - lb - cf - REV - no unit - scf - Nm3 - NL - P.</p> <p>Alteration of the measurement unit will have consequences for operator and SETUP-level values. Please note that the Span has to be adapted as well; the calculation is not done automatically.</p>
<b>TIME UNIT 42</b>	<p>The flowrate can be calculated per second (SEC), minute (MIN), hour (HR) or day (DAY).</p>
<b>DECIMALS 43</b>	<p>This setting determines for flowrate the number of digits following the decimal point. The following can be selected:</p> <p style="text-align: center;">00000 - 1111.1 - 2222.22 - 3333.333</p>
<b>SPAN 44</b>	<p>With the span, the flowmeter signal is converted to a quantity. The <b>span for flowrate</b> is determined on the basis of the <b>selected measurement unit and time unit</b> at 20mA. Enter the span in whole numbers (decimals are set with SETUP 45). The more accurate the span, the more accurate the functioning of the system will be.</p> <p><b>Example 1     Calculating the span for flowrate</b> <i>Let us assume that the flowmeter generates 20mA at a flowrate of 2,481.3 Liters/minute, the selected unit is "Liters" and time unit "minute". The span is 2481.3 Enter for SETUP - 44: "248130" and for SETUP - 45 - decimals span "2".</i></p> <p><b>Example 2     Calculating the span for flowrate</b> <i>Let us assume that the flowmeter generates 20mA at a rate of 652.31 USGAL per hour, the selected unit is USG and the time unit is minute. The span is 652.31 / 60 minutes is 10.87183 (GPM). Enter for SETUP - 44: "108718" and for SETUP - 45 "4".</i></p>
<b>DECIMALS SPAN 45</b>	<p>This setting determines the number of decimals for Span (SETUP 44). The following can be selected:</p> <p style="text-align: center;">0 - 1 - 2 - 3 - 4 - 5 - 6</p> <p>Please note that this SETUP - influences the accuracy of the Span indirectly. This setting has NO influence on the displayed number of digits for "flowrate" (SETUP 43)!</p>



5 - DISPLAY	
<b>FUNCTION 51</b>	The large 17mm digits can be set to display the total or flowrate. When "total" is selected, both total and flowrate are displayed simultaneously. When "flowrate" is selected, only flowrate will be displayed with it's measuring unit while total will be displayed after pressing SELECT.
<b>DISPLAY 52</b>	This function determines if the main display information - flowrate/total - of both flows is displayed automatically or after pressing the SELECT button. With "toggle", the main information of one flow will be displayed during 7 seconds followed by the other flow for 7 seconds etc. etc. With "hand", all info must be selected manually.
<b>ACC TOTAL 53</b>	Accumulated total of both flows can be switched off to make the operator level less complicated. Note that accumulated total will be calculated at all times even when this display-function disabled.

6 - POWER MANAGEMENT	
When used with the internal battery option, the user can expect reliable measurement over a long period of time. The F111-A has several smart power management functions to extend the battery life time significantly. Two of these functions can be set:	
<b>LCD NEW 61</b>	<p>The calculation of the display-information influences the power consumption significantly. When the application does not require a fast display update, it is <b>strongly advised</b> to select a slow refresh rate. Please understand that NO information will be lost; every pulse will be counted and the output signals will be generated in the normal way. The following can be selected:</p> <p style="text-align: center;">Fast - 1 sec - 3 sec - 15 sec - 30 sec - off.</p> <p><b>Example 3: Battery life-time</b>  <i>battery life-time with a coil pick-up, 1KHz. pulses and FAST update: about 2 years.</i>  <i>battery life-time with a coil pick-up, 1KHz. pulses and 1 sec update: about 5 years.</i></p> <p><b>Note:</b> after a button has been pressed by the operator - the display refresh rate will always switch to FAST for 30 seconds. When "OFF" is selected, the display will be switched off after 30 seconds and will be switched on as soon as a button has been pressed.</p>
<b>BATTERY-MODE 62</b>	The unit has two modes: operational or shelf. After "shelf" has been selected, the unit can be stored for several years; it will not count pulses, the display is switched off but all settings and totals are stored. In this mode, power consumption is extremely low. To wake up the unit again, press the SELECT-key twice.



Note !

## 7 - FLOWMETER A

<b>SIGNAL</b> 71	<p>The F111-A can process the (0)4-20mA signal in two ways:</p> <ul style="list-style-type: none"> <li>▪ Interpolation: the signal is processed linear</li> </ul> $\mathbf{R = S \times I}$ <ul style="list-style-type: none"> <li>▪ Square root: for differential pressure</li> </ul> $\mathbf{R = S \sqrt{I}}$ <p>where:</p> <p>R = Rate: the calculated flowrate                  S = Span: the maximum flowrate at 20mA. The span is programmed with setting 24 for flowrate and with setting 13 for total.                  I = Input: the scaled analog value; in these formulas value 0 (zero) for (0)4mA and value 1 (one) for 20mA.</p>
---------------------	--



<b>FILTER</b> 72	<p>The analog output signal of a flowmeter does mirror the actual flow. This signal is measured several times a second by the F111-A. The value measured is a "snap-shot" of the real flow as it will be fluctuating. With the help of this digital filter a stable and accurate reading can be obtained while the filter level can be set to a desired value.</p> <p>The filter principal is based on three input values: the filter level (01-99), the last measured analog value and the last average value. The higher the filter level, the longer the response time on a value change will be. Below, several filter levels with there response times are indicated:</p>
---------------------	--

FILTER VALUE	RESPONSE TIME ON STEP CHANGE OF ANALOG VALUE.			
	TIME IN SECONDS			
	50% INFLUENCE	75% INFLUENCE	90% INFLUENCE	99% INFLUENCE
01	filter disabled	filter disabled	filter disabled	filter disabled
02	0.3 seconds	0.5 seconds	1.0 seconds	1.8 seconds
03	0.5 seconds	1.0 seconds	1.5 seconds	3 seconds
05	1.0 seconds	1.8 seconds	2.8 seconds	5.3 seconds
10	1.8 seconds	3.5 seconds	5.6 seconds	11 seconds
20	3.5 seconds	7.0 seconds	11 seconds	23 seconds
30	5.3 seconds	10 seconds	17 seconds	34 seconds
50	8.8 seconds	17 seconds	29 seconds	57 seconds
75	13 seconds	26 seconds	43 seconds	86 seconds
99	17 seconds	34 seconds	57 seconds	114 seconds

Continued next page >>>

## 7 - FLOWMETER A (CONTINUED)

<b>CUT-OFF 73</b>	<p>To ignore e.g. leakage of the flow or vibration, a low-flow cut-off can be set as percentage over the full range of 16mA (or 20mA / 10V). When the analog value is less then required with this setting, the signal will be ignored.</p> <p>The cut-off value can be programmed is the range 0.0 - 99.9%.</p> <p><b>Examples:</b></p>			
FUNCTION (setup 71)	SPAN (setup 13/24)	REQUIRED CUT-OFF	CUT-OFF (setup 73)	REQUIRED OUTPUT
interpolation	450 L/min	25 L/min	$25/450 \times 100\% = 5.5\%$	$16\text{mA} \times 5.5\% + 4\text{mA} = 4.88\text{mA}$
square root	450 L/min	25 L/min	$(25/450)^2 \times 100\% = 0.3\%$	$16\text{mA} \times 0.3\% + 4\text{mA} = 4.05\text{mA}$
<b>TUNE MIN / 4MA 74</b>	<p>With this setting it is possible to calibrate the input value for (0)4mA as the signal from the flowmeter might not be exact 4.0 mA (or 0.0 mA) at flowrate zero.</p> <p>This function will measure the real output value at flow zero.</p> <ul style="list-style-type: none"> <li>▪ <i>Warning: be very sure that the offered signal is correct before the calibration is executed as this function has major influences on the accuracy of the system!</i></li> </ul> <p>After pressing PROG, three settings can be selected:</p> <ul style="list-style-type: none"> <li>▪ CALIBRATE: with this setting, the input will be calibrated with the actual "(0)4mA" value. After pressing enter, CAL SET will be displayed as soon as the calibration is completed. From that moment, the analog value must be more than the calibrated value before the signal will be processed.</li> <li>▪ DEFAULT: with this setting, the manufactures value is re-installed.</li> <li>▪ CAL SET: to select the last calibrated value.</li> </ul>			
<b>TUNE MAX / 20MA 75</b>	<p>With this setting it is possible to calibrate the input value for 20mA as the signal from the flowmeter might not be exact 20.0 mA at maximum flowrate.</p> <p>This function will measure the real output value at maximum flowrate.</p> <ul style="list-style-type: none"> <li>▪ <i>Warning: be very sure that the offered signal is correct before the calibration is executed as this function has major influences on the accuracy of the system!</i></li> </ul> <p>After pressing PROG, three settings can be selected:</p> <ul style="list-style-type: none"> <li>▪ CALIBRATE: with this setting, the input will be calibrated with the actual "20mA" value. After pressing enter, CAL SET will be displayed as soon as the calibration is completed. From that moment, the analog value must be less than the calibrated value for a reliable measurement.</li> <li>▪ DEFAULT: with this setting, the manufactures value is re-installed.</li> <li>▪ CAL SET: to select the last calibrated value.</li> </ul>			



<b>8 - FLOWMETER B</b>	
<b>SIGNAL</b> 81	<p>The F111-A can process the (0)4-20mA signal in two ways:</p> <ul style="list-style-type: none"> <li>▪ Interpolation: the signal is processed linear</li> <li>▪ Square root: for differential pressure</li> </ul> <p>For explanation of this function: please read "7 - Flowmeter A"</p>
<b>FILTER</b> 82	<p>With the help of this digital filter a stable and accurate reading can be obtained while the filter level can be set to a desired value.</p> <p>For explanation of this function: please read "7 - Flowmeter A"</p>
<b>CUT-OFF</b> 83	<p>To ignore e.g. leakage of the flow or vibration, a low-flow cut-off can be set as percentage over the full range of 16mA (or 20mA / 10V). When the analog value is less then required with this setting, the signal will be ignored.</p> <p>The cut-off value can be programmed is the range 0.0 - 99.9%.</p> <p>For explanation of this function: please read "7 - Flowmeter A"</p>
<b>TUNE MIN / 4MA</b> 84	<p>With this setting it is possible to calibrate the input value for (0)4mA as the signal from the flowmeter might not be exact 4.0 mA (or 0.0 mA) at flowrate zero.</p> <p>This function will measure the real output value at flow zero.</p> <ul style="list-style-type: none"> <li>▪ <i>Warning: be very sure that the offered signal is correct before the calibration is executed as this function has major influences on the accuracy of the system!</i></li> </ul> <p>For explanation of this function: please read "7 - Flowmeter A"</p>
<b>TUNE MAX / 20MA</b> 85	<p>With this setting it is possible to calibrate the input value for 20mA as the signal from the flowmeter might not be exact 20.0 mA at maximum flowrate.</p> <p>This function will measure the real output value at maximum flowrate.</p> <ul style="list-style-type: none"> <li>▪ <i>Warning: be very sure that the offered signal is correct before the calibration is executed as this function has major influences on the accuracy of the system!</i></li> </ul> <p>For explanation of this function: please read "7 - Flowmeter A"</p>



## 9 - PULSE OUTPUT A

*For each flowmeter input A and B, one transistor or mechanic relay output is available as scaled pulse output according to the accumulated total.*

<b>PERIOD TIME PULSE OUTPUT INPUT A 91</b>	<p>The period time determines the time that the transistor or relay will be switched; in other words the pulse length. The minimum time between the pulses is as long as the period time. One period is approx. 7.8 msec. If the value selected is "zero", the pulse output is disabled. The maximum value is 255 periods.</p> <p><b>Note:</b> <i>If the frequency should go out of range - when the flowrate increases for example - an internal buffer will be used to "store the missed pulses": As soon as the flowrate reduces again, the buffer will be "emptied".</i></p> <p><i>It might be that pulses will be missed due to a buffer-overflow, so it is advised to program this setting within it's range</i></p>																					
	<table border="1" style="margin: auto; border-collapse: collapse;"> <thead> <tr> <th style="padding: 2px;">NUMBER OF PERIODS</th> <th style="padding: 2px;">PERIOD TIME</th> <th style="padding: 2px;">MAX. FREQUENCY</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">disabled</td> <td style="text-align: center;">disabled</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">0,0078 seconds</td> <td style="text-align: center;">64 Hz.</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">0,0156 seconds</td> <td style="text-align: center;">32 Hz.</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">0,0234 seconds</td> <td style="text-align: center;">21 Hz.</td> </tr> <tr> <td style="text-align: center;">64</td> <td style="text-align: center;">0,5000 seconds</td> <td style="text-align: center;">1 Hz.</td> </tr> <tr> <td style="text-align: center;">255</td> <td style="text-align: center;">1,9922 seconds</td> <td style="text-align: center;">0.25 Hz.</td> </tr> </tbody> </table>	NUMBER OF PERIODS	PERIOD TIME	MAX. FREQUENCY	0	disabled	disabled	1	0,0078 seconds	64 Hz.	2	0,0156 seconds	32 Hz.	3	0,0234 seconds	21 Hz.	64	0,5000 seconds	1 Hz.	255	1,9922 seconds	0.25 Hz.
NUMBER OF PERIODS	PERIOD TIME	MAX. FREQUENCY																				
0	disabled	disabled																				
1	0,0078 seconds	64 Hz.																				
2	0,0156 seconds	32 Hz.																				
3	0,0234 seconds	21 Hz.																				
64	0,5000 seconds	1 Hz.																				
255	1,9922 seconds	0.25 Hz.																				
<b>PULSE PER INPUT A 92</b>	<p>According to the measurement unit settings for total, a pulse will be generated every X-quantity. Enter this quantity here while taking the displayed decimal position and measuring unit into account.</p>																					



Note !

## A - PULSE OUTPUT B

*For each flowmeter input A and B, one transistor or mechanic relay output is available as scaled pulse output according to the accumulated total.*

<b>PERIOD TIME PULSE OUTPUT INPUT B A1</b>	<p>This setup function determines the pulse length for <b>input B</b> as described accordingly for input A - setup 91.</p>
<b>PULSE PER INPUT A A2</b>	<p>This setup function determines the quantity for <b>input B</b> as described accordingly for input A - setup 92.</p>

<b>B - COMMUNICATION (OPTIONAL)</b>	
The functions described below deal with hardware that is not part of the standard delivery. Programming of these functions does not have any effect if this hardware has not been installed. Consult Appendix C and the Modbus communication protocol description for a detailed explanation.	
<b>BAUDRATE B1</b>	For external control, the following communication speeds can be selected:  1200 - 2400 - 4800 - 9600 baud
<b>BUS ADDRESS B2</b>	For communication purposes, a unique identity can be attributed to every F111-A. This address can vary from 1-255.
<b>MODE B3</b>	The communication protocol is Modbus ASCII or RTU mode. Select OFF, to disable this communication function.

<b>C - OTHERS</b>	
<b>TYPE OF MODEL C1</b>	For support and maintenance it is important to have information about the characteristics of the F111-A. Your supplier will ask for this information in the case of a serious breakdown or to assess the suitability of your model for upgrade considerations.
<b>VERSION SOFTWARE C2</b>	For support and maintenance it is important to have information about the characteristics of the F111-A. Your supplier will ask for this information in the case of a serious breakdown or to assess the suitability of your model for upgrade considerations.
<b>SERIAL NUMBER C3</b>	For support and maintenance it is important to have information about the characteristics of the F111-A. Your supplier will ask for this information in the case of a serious breakdown or to assess the suitability of your model for upgrade considerations.
<b>PASS CODE C4</b>	All SETUP-values can be pass code protected. This protection is disabled with value 0000 (zero). Up to and including 4 digits can be programmed, for example 1234.
<b>TAGNUMBER C5</b>	For identification of the unit and communication purposes, a unique tag number of maximum 7 digits can be entered.

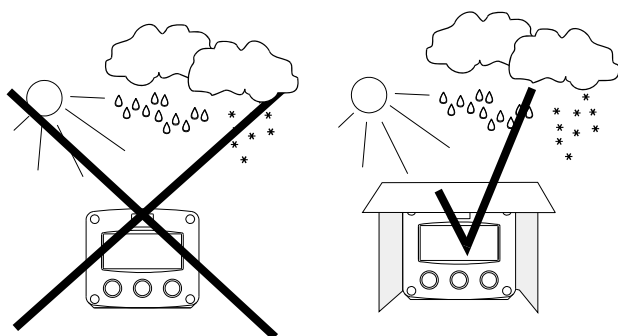
## 4. INSTALLATION



### 4.1. GENERAL DIRECTIONS

- Mounting, electrical installation, start-up and maintenance of this instrument may only be carried out by trained personnel authorized by the operator of the facility. Personnel must read and understand this Operating Manual before carrying out its instructions.
- The F111-A may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.
- Ensure that the measuring system is correctly wired up according to the wiring diagrams. Protection against accidental contact is no longer assured when the housing cover is removed or the panel cabinet has been opened (danger from electrical shock). The housing may only be opened by trained personnel.
- Take careful notice of the " Safety rules, instructions and precautionary measures " at the front of this manual.

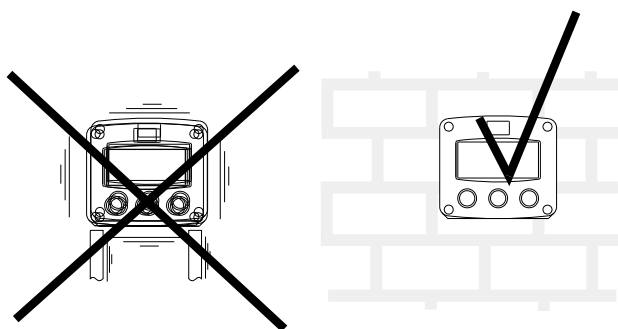
### 4.2. INSTALLATION / SURROUNDING CONDITIONS



Take the relevant IP classification of the casing into account (see manufactures plate). Even an IP67 (NEMA 4X) casing should NEVER be exposed to strongly varying (weather) conditions.

When panel-mounted, the unit is IP65 (NEMA 4X)!

When used in very cold surroundings or varying climatic conditions, take the necessary precautions against moisture by placing a dry sachet of silica gel, for example, inside the instrument case.



Mount the F111-A on a solid structure to avoid vibrations.

4.3. DIMENSIONS- ENCLOSURE

Aluminum enclosures:

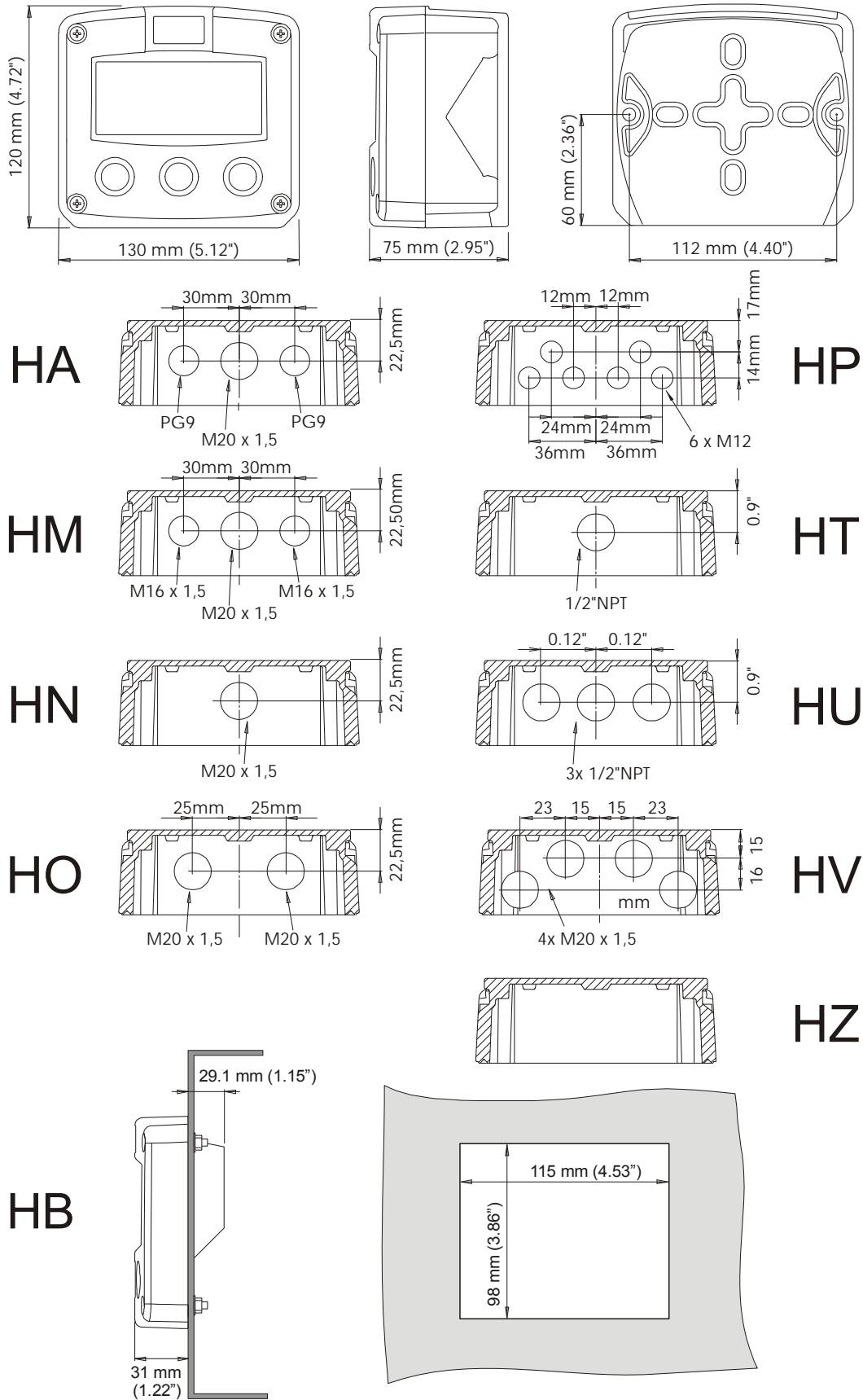
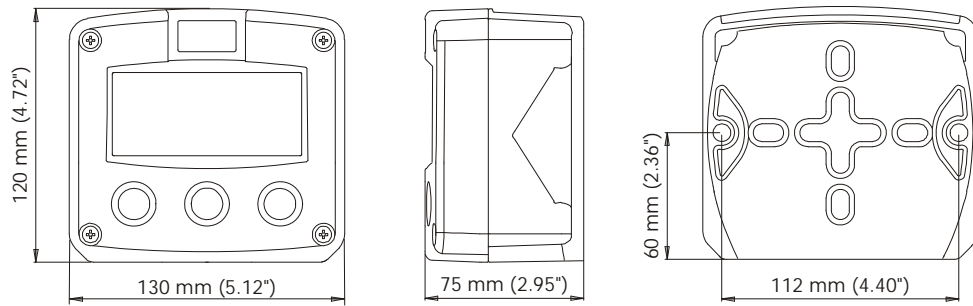


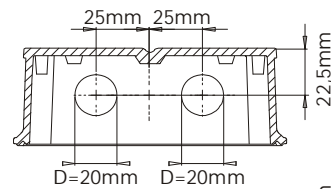
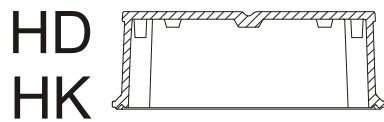
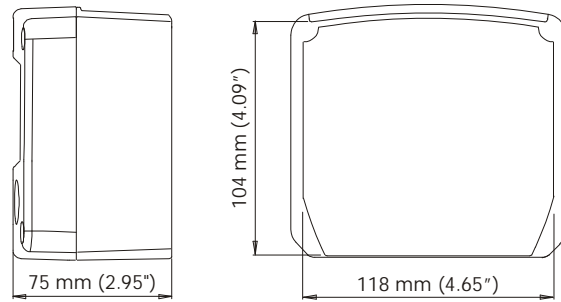
Fig. 5: Dimensions aluminum enclosures



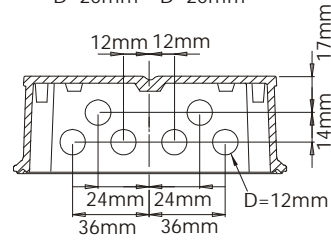
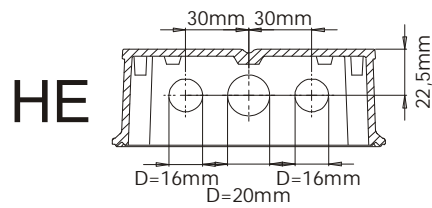
GRP enclosures:



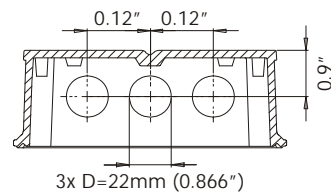
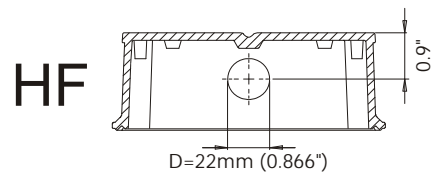
HK back box:  
(flat bottom)



HG



HH



HJ

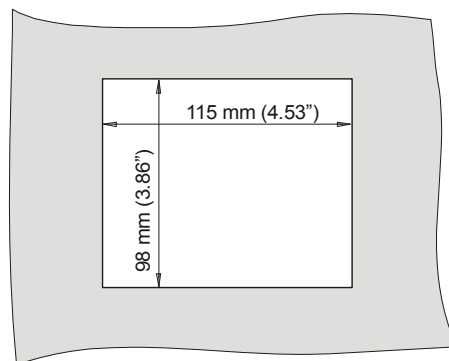
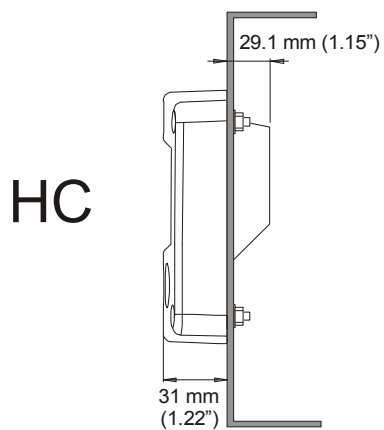


Fig. 6: Dimensions GRP enclosures

#### 4.4. INSTALLING THE HARDWARE



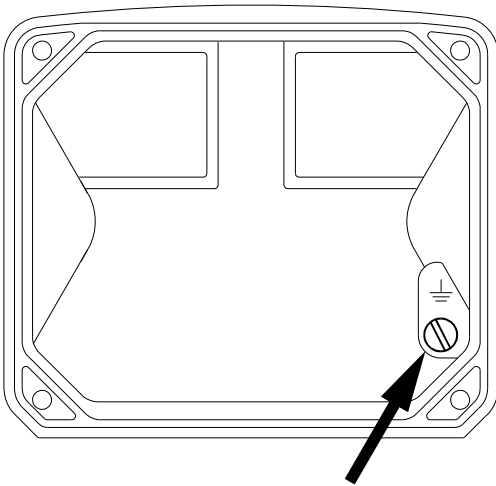
##### 4.4.1. INTRODUCTION

- Electro static discharge does inflict irreparable damage to electronics! Before installing or opening the unit, the installer has to discharge himself by touching a well-grounded object.
- This unit must be installed in accordance with the EMC guidelines (Electro Magnetic Compatibility).



##### Aluminum enclosures

- When installed in an aluminum enclosure and a potentially explosive atmosphere requiring apparatus of equipment protection level Ga and Da, the unit must be installed such that, even in the event of rare incidents, an ignition source due to impact or friction sparks between the enclosure and iron/steel is excluded.
- Do ground the aluminum enclosure properly as indicated, if the F111-A has been supplied with the 115-230V AC power-supply type PM. The green / yellow wire between the back-casing and removable terminal-block may never be removed.



*Fig. 7: Grounding aluminum enclosure with type PM 115-230V AC*

#### FOR INSTALLATION, PAY EMPHATIC ATTENTION TO:

- Separate cable glands with effective IP67 (NEMA4X) seals for all wires.
- Unused cable entries: ensure that you fit IP67 (NEMA4X) plugs to maintain rating.
- A reliable ground connection for both the sensor, and if applicable, for the metal casing.
- An effective screened cable for the input signal, and grounding of its screen to terminal 9 (GND) or at the sensor itself, whichever is appropriate to the application.

#### 4.4.2. VOLTAGE SELECTION SENSOR SUPPLY

**For *Intrinsically Safe* applications: read chapter 5.**

##### **Type PB / PC / PX (AP) - battery powered and output loop-powered applications:**

Terminal 11 provides a limited supply voltage of 3.2 V DC. This is not suitable to power analog sensors.

##### **Type PD / PF / PM: Sensor supply: 3.2V, 8.2V, 12V or 24 V DC:**

With this option, a real power supply for the sensor is available. The sensor can be powered with 8.2, 12 or 24 V DC.

Total power consumption PD: max. 50mA@24V and PF / PM: max. 400mA@24V.

The voltage is selected with the three switches inside the enclosure.



- **Warning:** be sure that all the leads to the terminals are disconnected from the unit when the internal plastic protection cover has been removed !
- **HIGH VOLTAGE 400V !! NEVER** connect the mains power supply to the unit when the plastic protection cover has been removed !!!

First, remove the terminal strip(s) after which the internal plastic cover can be removed. The switches are located in the top left corner (type PD) or on the right hand (type PF / PM) as indicated:

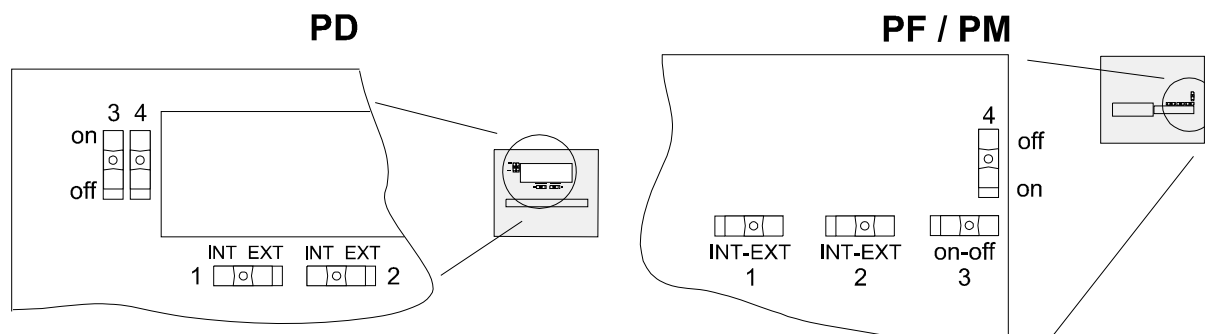


Fig. 8: Switch setting sensor supply voltage.

#### Switch positions

SENSOR A	
SWITCH 1	VOLTAGE
internal	3.2 V DC
external	switch 3+4

SENSOR B	
SWITCH 2	VOLTAGE
internal	3.2 V DC
external	switch 3+4

VOLTAGE SELECTION		
SWITCH 3	SWITCH 4	VOLTAGE
on	on	8.2 V DC
on	off	12 V DC
off	off	23 V DC

**Function switch 1:** voltage selection sensor A - terminal 11.

**Function switch 2:** voltage selection sensor B - terminal 14.

**Function switch 3+4:** the combination of these switches determine the voltage as indicated. Do move switch 1 and / or switch 2 to the OFF position to enable the selected voltage with switch 3+4.

**4.4.3. TERMINAL CONNECTORS**

For *Intrinsically Safe* applications: read chapter 5.

The following terminal connectors are available:

POWER SUPPLY TYPE PD / PF / PM	PULSE OUTPUT B TYPE OA / OT / OR		PULSE OUTPUT A TYPE OA / OT / OR		POWER SUPPLY TYPE PX 8-24V DC (standard)		SENSOR A INPUT (0)4-20mA		SUPPLY DC		SENSOR B INPUT (0)4-20mA		SUPPLY DC	
GND ⊥	1 N	2 L1	3 R2 ⊥	4 R2	5 R1 ⊥	6 R1	7 ⊥	8 +↑	9 ⊥	10 I↑	11 +↓	12 ⊥	13 I↑	14 +↓

Fig. 9: Overview of terminal connectors standard configuration F111-A and options

**REMARKS: TERMINAL CONNECTORS:**

**Terminal GND- 01- 02: Power Supply - only available with type PD / PF or PM:**

TYPE	SENSOR SUPPLY	Terminal			backlight			Type OA	Type OR
		GND	01	02					
PD 8-24V AC	8.2, 12, 24V max. 50mA		AC	AC	◇			◇	
PD 8-30V DC	8.2, 12, 24V max. 50mA	L-	L+		◇			◇	
PF 24V AC ± 15%	8.2, 12, 24V max. 50mA		AC	AC	◇				◇
PF 24V DC ± 15%	8.2, 12, 24V max. 50mA	L-	L+		◇				◇
PM 115-230V AC ± 15%	8.2, 12, 24V max. 50mA	EARTH	AC	AC	◇			◇	◇
Note PD	do not use a AC autotransformer (Spartrafo) without a galvanic isolation.								
Note PF / PM	The total consumption of the sensors and outputs may not exceed 400mA@24V								

◇=option



**Note: for power supply type PX: please read Terminal 07-08 !**

For *Intrinsically Safe* applications: read chapter 5.

**Terminal 03-04; scaled pulse output R1:**

Setup A (par. 3.4.4.) determines the pulse output function related to sensor input B. The maximum pulse frequency of this output is 60Hz. If a relay output option has been supplied, be sure that the output frequency does not exceed 5Hz or else the life-time of the relay will be reduced significantly.

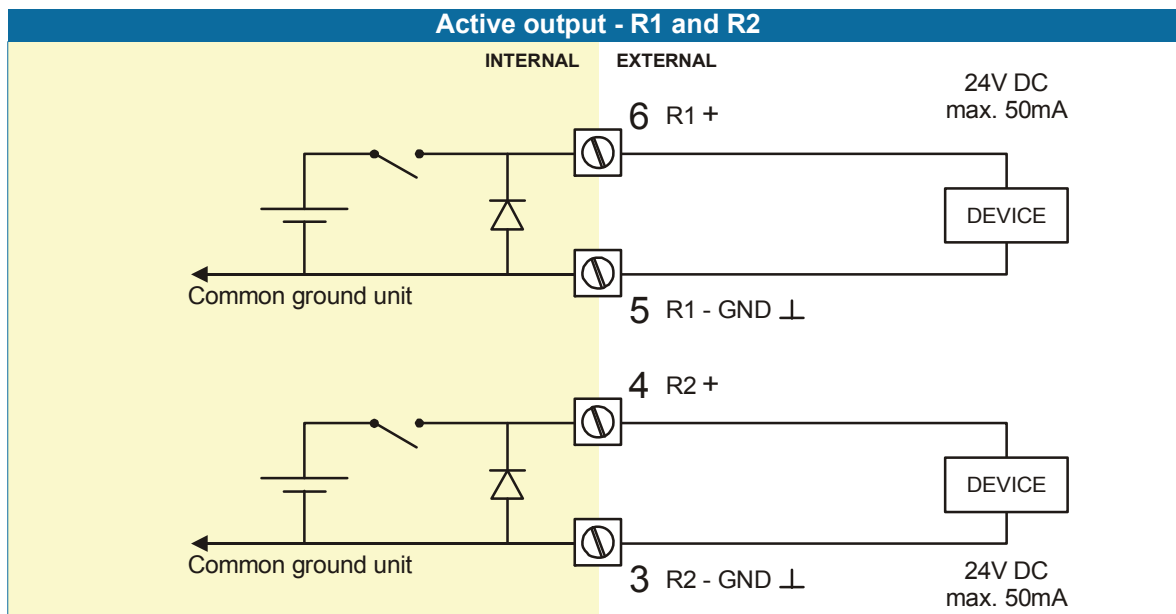
**Terminal 05-06; scaled pulse output R1:**

Setup 9 (par. 3.4.4.) determines the pulse output function related to sensor input A. The maximum pulse frequency of this output is 60Hz. If a relay output option has been supplied, be sure that the output frequency does not exceed 5Hz or else the life-time of the relay will be reduced significantly.

**Type OA:**

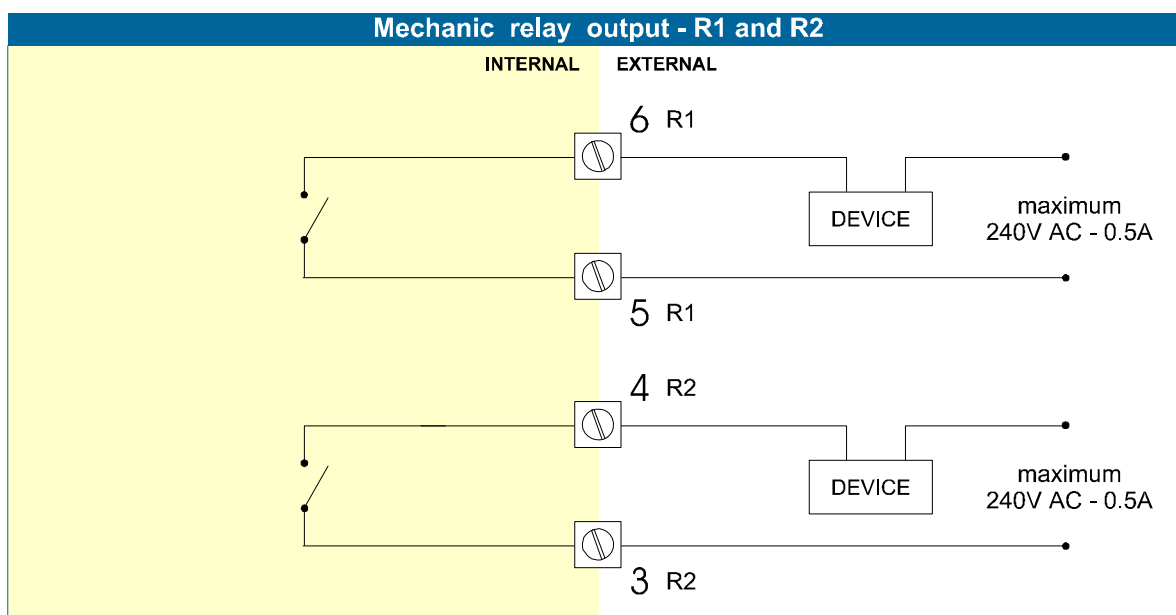
An active 24V DC signal output is available with this option.

Max. driving capacity 50mA@24V per output. (Requires power supply type PD / PF / PM).

**Type OR:**

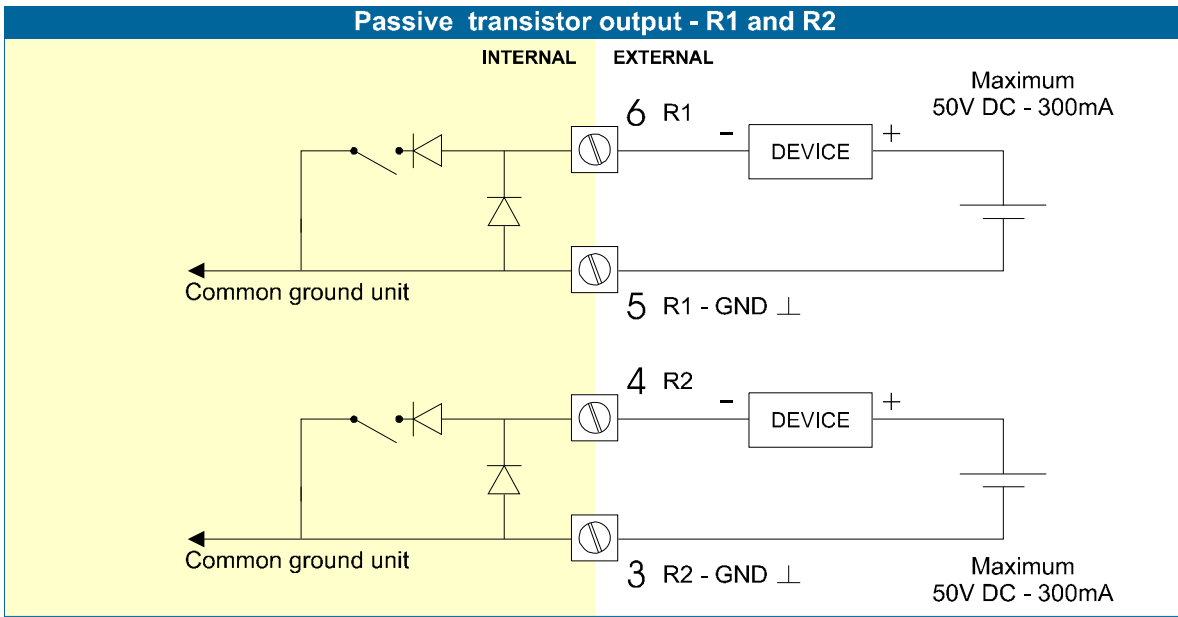
A mechanical relay output is available with this option.

Max. switch power 240V-0,5A per output. (Requires power supply type PF / PM).



**Type OT:**

A passive transistor output is available with this option. Max. driving capacity 300mA@50V DC.

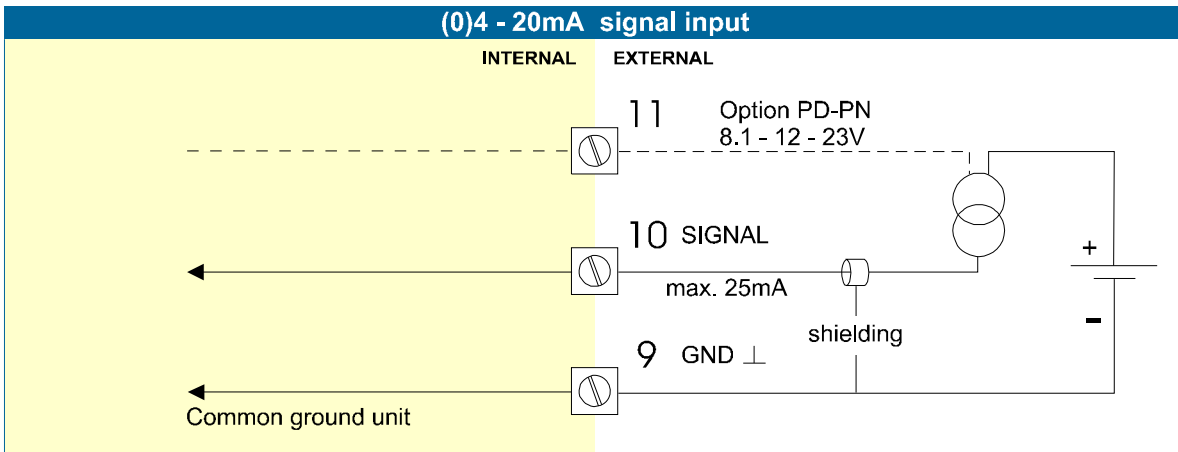


**Terminal 07-08; basic POWER SUPPLY - type PX:**

Connect an external power supply of 8-30VDC to these terminals. Do not connect the "-" to terminal 7 and the "+" to terminal 8. When power is applied to these terminals, the (optional) internal battery will be disabled / enabled automatically to extend the battery life time.

**Terminal 09-11: Type A – Flowmeter input (general)**

The F111-A requires a (0)4-20mA flowmeter signal which will be processed 4 times a second with a 14 bits accuracy. The input is not isolated.

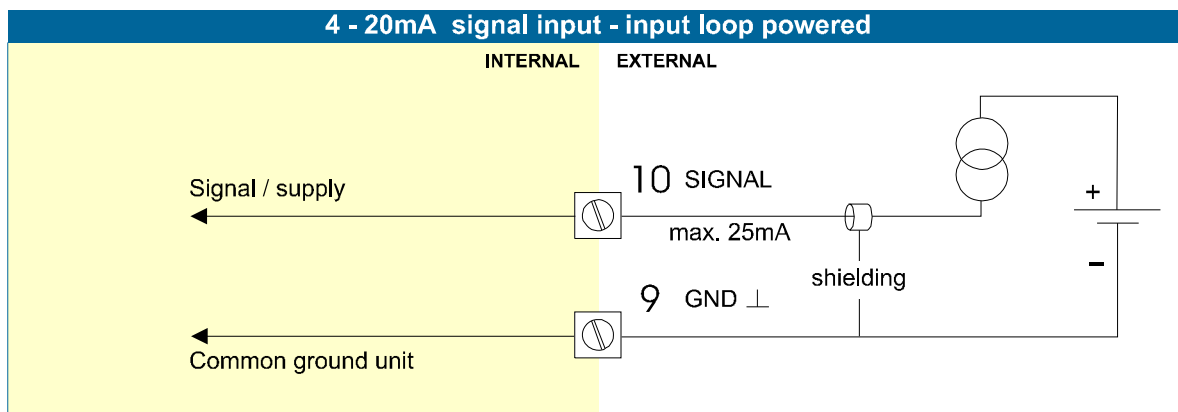


**For Intrinsically safe applications (without input loop power): please read chapter 5.**

**Terminal 09-10: Type A-PL – Flowmeter input / power supply:**

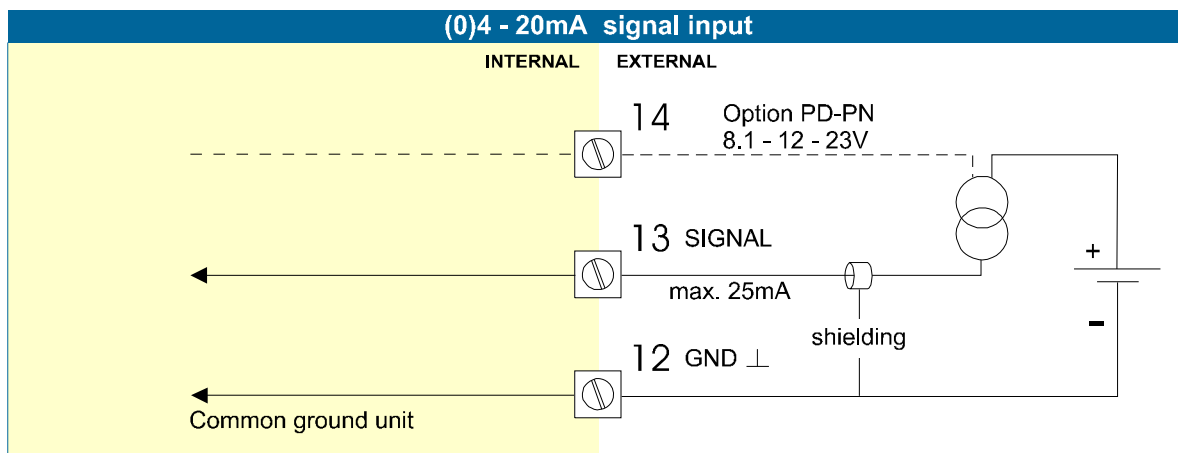
The F111-A-PL requires a 4-20mA flowmeter signal which has a double function:

The signal will be processed 4 times a second with a 14 bits accuracy and the unit will be powered from the sensor signal (input loop powered). The input is not isolated and not intrinsically safe.



**Terminal 12-14; Flowmeter input B:**

The F111-A requires a (0)4-20mA flowmeter signal which will be processed 4 times a second with a 14 bits accuracy. The input is not isolated.



**Terminal 26-31: type CB / CH / CI / CT - communication RS232 / RS485 / TTL (option)**

- Full serial communications and computer control in accordance with RS232 (length of cable max. 15 meters) or RS485 (length of cable max. 1200 meters) is possible.
- Read the Modbus communication protocol and Appendix C.

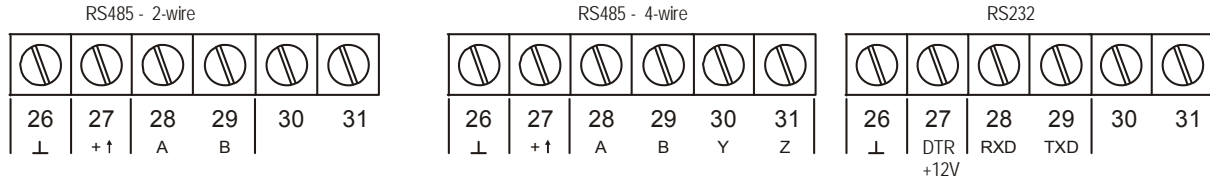


Fig. 10: Overview terminal connectors communication option.

When using the RS232 communication option, terminal 27 is used for supplying the interface. Please connect the DTR (or the RTS) signal of the interface to this terminal and set it active (+12V). If no active signal is available it is possible to connect a separate supply between terminals 26 and 27 with a voltage between 8V and 24V.

**Terminal 26-31: backlight - type ZB (option):**



**Note: if the unit is supplied with a power supply type PD, PF or PM, the backlight supply is integrated, so the text following is not applicable.**

To power the backlight, provide a 12-24V DC to terminal 26 (-) and 27 (+). An external trimmer 1kOhm trimmer can be used to tune the brightness of the backlight, or if not desired, a short-cut between these terminals have to be made which will result in the maximum brightness.



**Note: Intrinsically Safe as well as 4-wire RS485 communication is not possible in combination with type ZB, except if a PD, PF or PM power supply is being used.**

Option type ZB: adjustable backlight

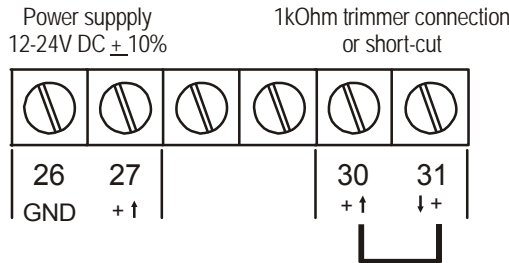


Fig. 11: Overview terminal connectors backlight option



## 5. INTRINSICALLY SAFE APPLICATIONS

### 5.1. GENERAL INFORMATION AND INSTRUCTIONS



Caution !

#### Cautions

- Mounting, electrical installation, start-up and maintenance of this device may only be carried out by trained personnel authorized by the operator of the facility. Personnel must read and understand this Operating Manual before carrying out its instructions.
- This device may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.
- Ensure that the measuring system is correctly wired up according to the wiring diagrams. Protection against accidental contact is no longer assured when the housing cover is removed or the cabinet has been opened (danger of electric shock). The housing may only be opened by trained personnel.
- To maintain the degree of protection of at least IP65 in accordance with IEC 60529, certified cable entries in accordance with IEC 61241-0 must be used and correctly installed. Unused openings must be closed with suitable blanking elements.
- When the enclosure of the Indicator is made of aluminum alloy, when used in a potentially explosive atmosphere requiring apparatus of equipment protection level Ga and Da, the unit must be installed such that, even in the event of rare incidents, an ignition source due to impact or friction sparks between the enclosure and iron/steel is excluded.
- Take careful notice of the " Safety rules, instructions and precautionary measures " in the front of this manual.



#### Safety Instructions

- When two or more active intrinsically safe circuits are connected to the indicator, in order to prevent voltage and/or current addition, applicable to the external circuits, precautions must be taken to separate the intrinsically safe circuits in accordance with IEC 60079-11.
- For the combined connection of the different supply, input and output circuits, the instructions in this manual must be observed.
- From the safety point of view the circuits shall be considered to be connected to earth.
- For installation under ATEX directive: this intrinsically safe device must be installed in accordance with the ATEX directive 94/9/EC and the product certificate KEMA 03ATEX1074 X.
- For installation under IECEx scheme: this intrinsically safe device must be installed in accordance with the product certificate IECEx DEK 11.0042X.
- Exchange of Intrinsically Safe battery FWLiBAT-0xx with certificate number KEMA 03ATEX1071 U or IECEx KEM 08.0005U is allowed in Hazardous Area. See paragraph 5.4. for detailed battery replacement instructions.



Note !

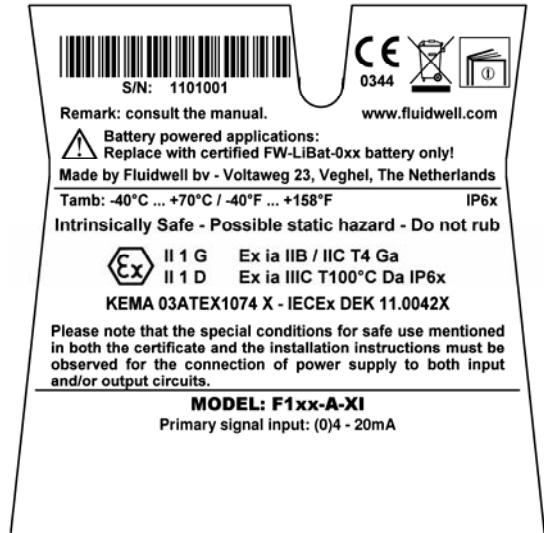
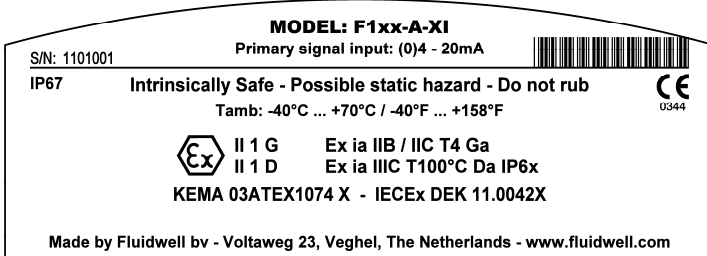
#### Please Note

- Certificates, safety values and declaration of compliance can be found in the document named: "Fluidwell F1...-XI - Documentation for Intrinsic Safety".
- Special conditions for safe use mentioned in both the certificate and the installation instructions must be observed for the connection of power to both input and / or output circuits.
- When installing this device in hazardous areas, the wiring and installation must comply with the appropriate installation standards for your industry.
- Study the following pages with wiring diagrams per classification.

**Label information (inside and outside the enclosure)**

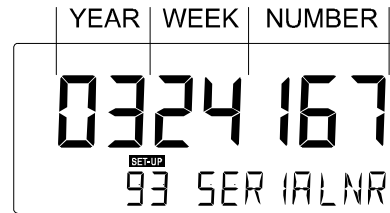
Indicated labels on the back cover (below) and on the inside cover (right) show the type labels for intrinsically safe certified units.

For details on usage see the separate “Fluidwell F1...-XI Documentation for Intrinsic Safety”.



**Serial number and year of production**

This information can be looked-up on the display: See setup function (par. 3.2.2.) for details.



**5.2. TERMINAL CONNECTORS INTRINSICALLY SAFE APPLICATIONS**

The unit is classified as group IIB/IIIC by default.



Note !

Classification of the unit as group IIC is only possible under the following conditions:

- The indicator is either supplied by
  - the internal supply (option -PC); or
  - the external supply connected to terminals 0 and 1 (option -PD); or
  - the circuit supply connected to terminals 7 and 8 (standard);
 The maximum values for any of those circuits are those as defined for group IIB/IIIC;
- No other active external intrinsically safe circuits may be connected to the indicator, with exception of circuits connected to terminals 3 and 4 and/or terminals 5 and 6; the maximum values for any of those circuits are those as defined for group IIB/IIIC

**Terminal connectors F111-A-XI:**

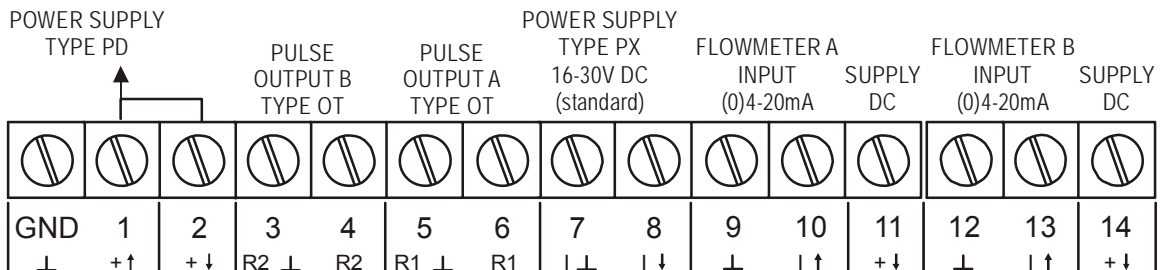


Fig. 12: Overview terminal connectors Intrinsically Safe option.

**Explanation Intrinsically Safe options:****Type PD - Intrinsically Safe power supply and sensor supply - Terminal GND- 01, 11 and 14.**

OPTION	SENSOR SUPPLY (TERMINAL 11 AND 14)	Terminal		
		GND	01	02
PD-XI Input voltage: 16-30V DC	= input voltage	L-	L+	output voltage is according the input voltage; internally linked with terminal 01.

Terminal 02, 11 and 14: these terminals offer the same voltage as connected to terminal 01.

5.3. CONFIGURATION EXAMPLES INTRINSICALLY SAFE APPLICATIONS

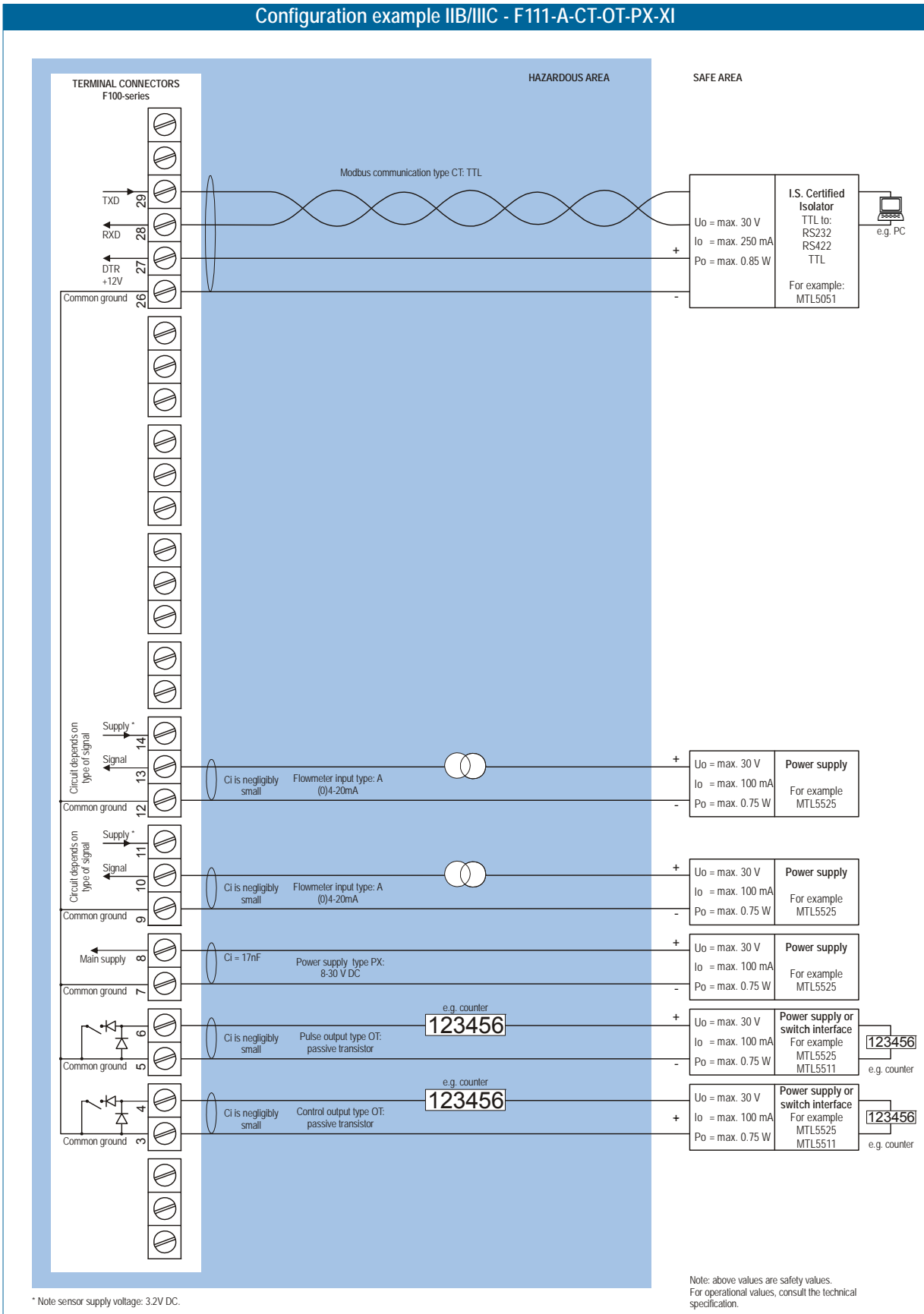


Fig. 13: Configuration example 1 Intrinsically Safe

Configuration example IIB/IIIC and IIC - F111-A-(CT)-OT-PD-XI

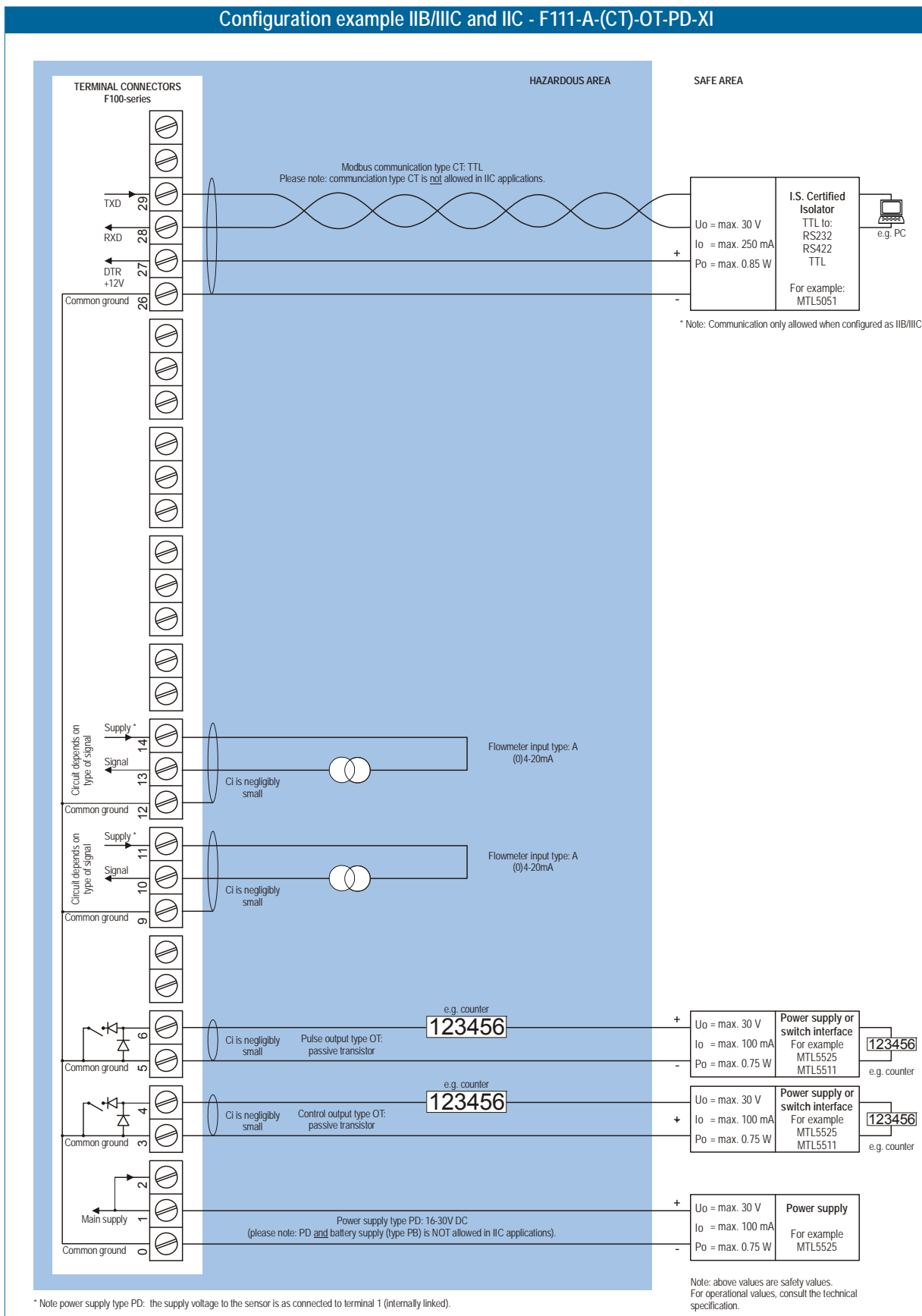


Fig. 14: Configuration example 2 Intrinsically Safe

## 5.4 BATTERY REPLACEMENT INSTRUCTIONS



### Safety Instructions

- **Fire, explosion or severe burns may result if mistreated.** Do not recharge, crush, disassemble, incinerate, heat above 100°C (212°F) or expose contents to water.
- Mounting, electrical installation, start-up and maintenance of this device may only be carried out by trained personnel authorized by the plant operator. Personnel must read and understand this instruction before carrying out the replacement procedure.
- Always follow the instructions listed in the supplied Battery Replacement Instruction Sheet.
- Batteries pose an environmental hazard. Return used batteries to a recycling point.



### Safety instructions for hazardous areas

- Verify the correct battery is supplied: **Only batteries with indicated Ex label are certified for replacement and use in hazardous areas.** Batteries for use in safe areas have no Ex label. **DO NOT EXCHANGE:** Using the wrong type of battery can pose a SERIOUS RISK.
- **For use in hazardous areas Fluidwell recommends FW-LiBAT type batteries (manufactured by Fluidwell bv) only.**

### Battery replacement procedure



Depending on the production batch, one of two visualized Intrinsically Safe certified battery types may have been installed in the unit. They are interchangeable.

FW-LiBAT-001 battery	FW-LiBAT-021 battery
 II 1 G Ex ia IIC Ga Ex ia IIC KEMA 03ATEX1071 U IECEX KEM 08.0005U Fluidwell bv Intrinsically Safe Battery Part. no.: FW-LiBAT-001 Uo = 3.9V Co = 100µF Io = 35mA Lo = 25mH Po = 35mW Ta = -40°C...+70°C Primary Lithium Battery Only replace with Fluidwell I.S. battery pack!	 II 1 G Ex ia IIC Ga KEMA 03ATEX1071 U IECEX KEM 08.0005U Fluidwell bv Intrinsically Safe Battery Part. no.: FW-LiBAT-021 Uo = 3.9V Co = 100µF Io = 35mA Lo = 25mH Po = 35mW Ta = -40°C...+70°C Primary Lithium Battery Only replace with Fluidwell I.S. battery pack!

1. To replace the battery, open the unit to gain access to the back inside cover of the unit
2. Unplug the field connectors from the back inside of the unit.
3. Remove the screw that holds the plastic inside cover.
4. Open the cover and unplug the battery connector.
5. Remove the battery from the inside of the plastic cover. *Do not remove the battery clip!*
6. Install the new battery and re-assemble the unit in reverse order.
7. Start-up the unit

## 6. MAINTENANCE

### 6.1. GENERAL DIRECTIONS



Caution !

- Mounting, electrical installation, start-up and maintenance of the instrument may only be carried out by trained personnel authorized by the operator of the facility. Personnel must read and understand this Operating Manual before carrying out its instructions.
- The F111-A may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed.
- Ensure that the measuring system is correctly wired up according to the wiring diagrams. Protection against accidental contact is no longer assured when the housing cover is removed or the panel cabinet has been opened (danger from electrical shock). The housing may only be opened by trained personnel.
- Take careful notice of the " Safety rules, instructions and precautionary measures " in the front of this manual.

The F111-A does not require special maintenance unless it is used in low-temperature applications or surroundings with high humidity (above 90% annual mean). It is the users responsibility to take all precautions to dehumidify the internal atmosphere of the F111-A in such a way that no condensation will occur, for example by placing dry silica-gel sachet in the casing just before closing it. Furthermore, it is required to replace or dry the silica gel periodically as advised by the silica gel supplier.

#### **Battery life-time:**

It is influenced by several issues :

- Display update: fast display update uses significantly more power; SETUP 61.
- Pulse output and communications .
- Low temperatures; the available power will be less due to battery chemistry.



Note !

**Note:** *It is strongly advised to disable unused functions.*

#### **Check periodically:**

- The condition of the casing, cable glands and front panel.
- The input/output wiring for reliability and aging symptoms.
- The process accuracy. As a result of wear and tear, re-calibration of the flowmeter might be necessary. Do not forget to re-enter any subsequent K-factor alterations.
- The indication for low-battery.
- Clean the casing with soapy-water. Do not use any aggressive solvents as these might damage the coating.

## APPENDIX A: TECHNICAL SPECIFICATION

### GENERAL

Display	
Type	High intensity reflective numeric and alphanumeric LCD, UV-resistant.
Digits	Seven 17mm (0.67") and eleven 8mm (0.31"). Various symbols and measuring units.
Refresh rate	User definable: 8 times/sec - 30 secs.
Type ZB	Transflective LCD with green LED backlight. Good readings in full sunlight and darkness. Note: only available for safe area applications. Power requirements: 12-24V DC + 10% or type PD, PF, PM. Power consumption max. 1 Watt.

Enclosures	
General	Die-cast aluminum or GRP (Glassfibre Reinforced Polyamide) enclosure with Polycarbonate window, silicone and EPDM gaskets. UV stabilized and flame retardant material.
Control Keys	Three industrial micro-switch keys. UV-stabilized silicone keypad.
Painting	Aluminum enclosure only: UV-resistant 2-component industrial painting.
Panel-mount enclosures	Dimensions: 130 x 120 x 60mm (5.10" x 4.72" x 2.38") – LxHxD.
Classification	IP65 / NEMA4X
Panel cut-out	115 x 98mm (4.53" x 3.86") LxH.
Type HC	GRP panel-mount enclosure
Type HB	Aluminum panel-mount enclosure
Field/wall-mount enclosures	Dimensions: 130 x 120 x 75mm (5.10" x 4.72" x 2.95") – LxHxD.
Classification	IP67 / NEMA4X
Aluminum enclosures	
Type HA	Drilling: 2x PG9 – 1x M20.
Type HM	Drilling: 2x M16 – 1x M20.
Type HN	Drilling: 1x M20.
Type HO	Drilling: 2x M20.
Type HP	Drilling: 6x M12.
Type HT	Drilling: 1x ½"NPT.
Type HU	Drilling: 3x ½"NPT.
Type HZ	No drilling.
GRP enclosures	
Type HD	No drilling.
Type HE	Drilling: 2x 16mm (0.63") – 1x 20mm (0.78").
Type HF	Drilling: 1x 22mm (0.87").
Type HG	Drilling: 2x 20mm (0.78").
Type HH	Drilling: 6x 12mm (0.47").

Operating temperature	
Operational	-40°C to +80°C (-40°F to +176°F)
Intrinsically Safe	-40°C to +70°C (-40°F to +158°F)


Power supply	
Type PB	Lithium battery - life-time depends upon settings - up to 5 years.
Type PC	Intrinsically Safe lithium battery - life-time depends upon settings - up to 5 years.
Type PD	8-24V AC / DC ± 10%. Power consumption max. 10 Watt. Intrinsically safe: 16-30V DC; power consumption max. 0.75 Watt.
Type PF	24V AC / DC ± 10%. Power consumption max. 15 Watt.
Type PL	Input loop powered from sensor signal 4-20mA (type A, non IS).
Type PM	115-230V AC ± 10%. Power consumption max. 15 Watt.
Type PX	Output loop powered: 8-30V DC. Power consumption max. 0.5 Watt.
Note PF / PM	The total consumption of the sensors, backlight and outputs may not exceed 400mA@24V.
Note I.S. applications	For intrinsically safe applications, consult the safety values in the certificate.



Sensor excitation	
Type PB / PC / PX	3.2V DC for pulse signals and 1.2V DC for coil pick-up. Note: This is not a real sensor supply. Only suitable for pulse sensors with a very low power consumption like coils (sine wave) and reed-switches.
Type PD	1.2 - 3.2 - 8.2 - 12 and 24V DC - max. 50mA@24V DC
Type PD-XI	Intrinsically safe: Pulse signals: 1.2 - 3.2 - 8.2 - max. 7mA@8.2V DC. Analog signals: the sensor supply voltage is according to the power supply voltage connected to terminal 1. Also terminal 2 offers the same voltage.
Type PF / PM	1.2 - 3.2 - 8.2 - 12 and 24V DC - max. 400mA@24V DC.

Terminal connections	
Type:	Removable plug-in terminal strip. Wire max. 1.5mm <sup>2</sup> and 2.5mm <sup>2</sup> (Type PM / PF)

Data protection	
Type	EEPROM backup of all setting. Backup of running totals every minute. Data retention at least 10 years.
Pass code	Configuration settings can be pass code protected.

Hazardous area (option)	
Intrinsically safe Type XI	<b>ATEX approval:</b>  II 1 G Ex ia IIB/IIC T4 Ga II 1 D Ex ia IIIC T100°C Da IP6x  <b>IECEx approval:</b> Ex ia IIB/IIC T4 Ga Ex ia IIIC T100°C Da IP6x
Explosion proof Type XD/XF	ATEX approval ref.: <EX> II 2 GD EEx d IIB T5. Weight appr. 15kg. Dimensions of enclosure: 350 x 250 x 200mm (13.7" x 9.9" x 7.9") LxHxD.

Environment	
Electromagnetic compatibility	Compliant ref: EN 61326 (1997), EN 61010-1 (1993).

## INPUTS

Flowmeter	
Type A	(0)4-20mA - with signal calibration feature at any current within the range.
Accuracy	Resolution: 14 bit.. Error < 0.025mA / ±0.125% FS. Low level cut-off programmable.
Span	0.000010 - 9,999,999 with variable decimal position.
Update time	Four times a second.
Voltage drop	2.5 Volt.
Load impedance	3kOhm
Relationship	Linear and square root calculation.
Note	For signal type A and U: external power to sensor is required; e.g. Type PD.

## OUTPUTS

Transistor outputs	
Pulse output	Two separated pulse outputs for flow A and flow B. Max. frequency 60Hz. Pulse length user definable between 7,8msec up to 2 seconds.
Function	Transmitting accumulated total.
Type OA	Active 24V DC transistor output; max. 50mA per output (requires type AA + PD, PF or PM).
Type OR	Isolated mechanic relay output; max. switch power 230V AC - 0,5A (requires type PF or PM).
Type OT	Passive transistor output - not isolated. Load max. 50V DC - 300mA.

Communication option	
Functions	reading display information, reading / writing all settings.
Protocol	Modbus ASCII or RTU
Speed	1200 - 2400 - 4800 - 9600 baud
Addressing	maximum 255 addresses.
Type CB	RS232
Type CH	RS485 2-wire
Type CI	RS485 4-wire
Type CT	TTL Intrinsically Safe communication.
Type CX	no communication.

## OPERATIONAL

Operator functions	
Displayed functions	<ul style="list-style-type: none"> <li>total and/or flowrate of flow A.</li> <li>total and accumulated total of flow A.</li> <li>total and/or flowrate of flow B.</li> <li>total and accumulated total of flow B.</li> <li>total of each flow can be reset to zero by pressing the CLEAR-key twice.</li> </ul>

Total	
Digits	7 digits.
Units	L, m3, GAL, USGAL, KG, lb, bbl, no unit.
Decimals	0 - 1 - 2 or 3.
Note 1	total can be reset to zero.
Note 2	all settings are available for both flows, completely separated.

Accumulated total	
Digits	11 digits.
Units / decimals	according to selection for total.

Flowrate	
Digits	7 digits.
Units	mL, L, m3, Gallons, KG, Ton, lb, bl, cf, RND, ft3, scf, Nm3, NI, igal - no units.
Decimals	0 - 1 - 2 or 3.
Time units	/sec - /min - /hr - /day.
Note	all settings are available for both flows, completely separated.

## APPENDIX B: PROBLEM SOLVING

In this appendix, several problems are included that can occur when the F111-A is going to be installed or while it is in operation.

### **Pulse output does not function:**

Check:

- SETUP 91 or A1 - pulse per "x" quantity; is the value programmed reasonable and will the maximum output be under 64Hz?
- SETUP 92 or A2 - impulse width; is the external device able to recognize the selected pulse width and frequency?

### **The pass code is unknown:**

If the pass code is not 1234, there is only one possibility left: call your supplier.

### **ALARM**

When the alarm flag starts to blink an internal alarm condition has occurred. Press the "select button" several times to display the 5-digit error code. The codes are:

0001: irrecoverable display-data error: data on the display might be corrupted.

0002: irrecoverable data-storage error: the programming cycle might have gone wrong: check programmed values.

0003: error 1 and error 2 occurred simultaneously

The alarm condition will almost certainly be handled internally and if all mentioned values still appear correct, no intervention by the operator is needed. If the alarm occurs more often or stays active for a longer time, please contact your supplier.

## APPENDIX C: COMMUNICATION VARIABLES

**Remarks:**

- Below, an overview of the F111-A specific variables; other common variables are described in the standard table.
- All numbers are decimal numbers, unless otherwise noted.
- The following variables of the standard table (var00-var30) are not valid for this product and will be responded with value 1: var00, 03-05, 07,08, 16-22, 24, 26-29.

CONFIGURATION VARIABLES F111-A - SETUP-LEVEL:				
VAR	DESCRIPTION	BYTES	VALUE	REMARKS
<b>TOTAL A</b>				
32 (20h)	unit	1	0=L 1=m3 2=kg 3=lb 4=gal 5=usgal 6=bb1 7=none	
33 (21h)	decimals	1	0...3	
34 (22h)	span	3	1....9.999.999	S 0000001 up to S 0000009 is allowed when decs < 6! (VAR37)
37 (25h)	decimals Span	1	0...6	
<b>FLOWRATE A</b>				
48 (30h)	unit	1	0=mL 1=L 2=m3 3=mg 4=g 5=kg 6=ton 7=gal 8=bb1 9=lb 10=cf 11=rev (revolutions for RPM) 12=none 13=scf 14=NM3 15=NL 16=p	
49 (31h)	time unit	1	0=sec 1=min 2=hour 3=day	
50 (32h)	decimals	1	0...1	
51 (33h)	span	3	1....9.999.999	S 0000001 up to S 0000009 is allowed when decs < 6! (VAR54)
54 (36h)	decimals span	1	0...6	

<b>TOTAL B</b>				
40 (28h)	span	3	1....9.999.999	S 0000001 up to S 0000009 is allowed when decs < 6! (VAR37)
43 (2Bh)	decimals Span	1	0...6	
<b>FLOWRATE B</b>				
227 (E3h)	span	3	1....9.999.999	S 0000001 up to S 0000009 is allowed when decs < 6! (VAR54)
230 (E6h)	decimals span	1	0...6	
<b>DISPLAY</b>				
64 (40h)	display function	1	0=total 1=flowrate	
65 (41h)	acc total	1	0=of 1=on	
66 (42h)	toggle	1	0=of 1=on	
<b>POWERMANAGEMENT</b>				
80 (50h)	LCD update time	1	0=fast 1=1sec 2=3sec 3=15sec 4=30sec 5=off	
81 (51h)	power-mode battery	1	0=operational 1=shelf	
<b>FLOWMETER A</b>				
98 (62h)	formula	1	0=linear 1=square root	
99 (63h)	filter	1	0....99	
100 (64h)	cut-off	2	0....999	steps of 0.1%
102 (66h)	calibration low (0)4mA	1	0=default 1=calibrate 2=cal set	
103 (67h)	calibration high 20mA	1	0=default 1=calibrate 2=cal set	
<b>FLOWMETER B</b>				
182 (B6h)	formula	1	0=linear 1=square root	
183 (B7h)	Filter	1	0....99	
184 (B8h)	cut-off	2	0....999	steps of 0.1%
186 (BAh)	Calibration low (0)4mA	1	0=default 1=calibrate 2=cal set	
187 (BBh)	calibration high 20mA	1	0=default 1=calibrate 2=cal set	

<b>PULSE OUTPUT</b>				
128 (80h)	impulse width A	1	0..255	
129 (81h)	pulse per X quantity A	3	1..9999999	unit, decimals acc. var32 -33
84h	impulse width B	1	0..255	
85h	pulse per X quantity B	3	1..9999999	unit, decimals acc. var32 -33
<b>OTHERS</b>				
168 (A8h)	pass code	2	xxxx	read only!
170 AAh	tagnumber	3	0..9999999	Other vars: see standard table

### OTHER F111-A VARIABLES FOR COMMUNICATION

#### TOTAL A - variable number 236h – 6 bytes

#### TOTAL B - variable number 436h – 6 bytes

Read total: The value of total read using RS communications might differ from the value that appears on the display. This is due to the fact that the display can only display up to seven digits ( for example when two decimals are selected for total and total has a value of 123456,78 the display will show 23456,78 while communication will read a “total” of 12345678 and a “total decimals” of 2).

Write total: total can only be cleared. This means writing a value different from 0 will result in the reply of an error message. Only writing 6 bytes of zero's to total will be accepted.

#### ACCUMULATED TOTAL A - variable number 230h – 6 bytes

#### ACCUMULATED TOTAL B - variable number 430h – 6 bytes

Read acc. total: A difference between the read value and the display value, as explained for “Read total”, might appear here too.

Write acc. total: Not possible.

When reading or writing total or accumulated total it should be noted that the used values are given including the decimals. This means that a read/write to one of these variables should be accompanied with a read/write to the variable that holds the number of decimals for this variable:

#### **Example: read var. 566 for total:**

*Read var. 33 for total decimals and calculate the real value of total by multiplying total with  $10^{-(total\ decimals)}$*

#### FLOWRATE A - variable number 23Ch – 4 bytes

#### FLOWRATE B - variable number 24Ch – 4 bytes

Read flowrate: The value difference as mentioned with total/acc. total might appear here too.

Write flowrate: Not possible.

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LIST OF CONFIGURATION SETTINGS			
SETTING	DEFAULT	DATE :	DATE :
<b>1 - TOTAL - A</b>			
11 unit	L		
12 decimals	0000000		
13 span	000001 /sec	/sec	/sec
14 decimals span	0		

SETTING	DEFAULT	DATE :	DATE :
<b>2 - FLOWRATE - A</b>			
21 unit	L		
22 time unit	/min		
23 decimals	0000000		
24 span	000001 /min		
25 decimals span	0		
<b>3 - TOTAL - B</b>			
31 unit	L		
32 decimals	0000000		
33 span	000001 /sec	/sec	/sec
34 decimals span	0		
<b>4 - FLOWRATE - B</b>			
41 unit	L		
42 time unit	/min		
43 decimals	0000000		
44 span	000001 /min		
45 decimals span	0		
<b>5 - DISPLAY</b>			
51 function	total		
52 display	toggle		
53 accumulated total	enable		
<b>6 - POWER MANAGEMENT</b>			
61 LCD-new	1 sec.		
<b>7 - FLOWMETER - A</b>			
71 formula	interpolation		
72 filter	01 (off)		
73 cut-off %	00.0%		
74 calibrat. low-(0)4mA	default		
75 calibrat. high-20mA	default		
<b>8 - FLOWMETER - B</b>			
81 formula	interpolation		
82 filter	01 (off)		
83 cut-off %	00.0%		
84 calibrat. low-(0)4mA	default		
85 calibrat. high-20mA	default		
<b>9 - PULSE OUTPUT - A</b>			
91 impulse width - flow A	000 periods		
92 pulse per - flow A	0001000		
<b>A - PULSE OUTPUT - B</b>			
A1 impulse width - flow A	000 periods		
A2 pulse per - flow A	0001000		
<b>B - COMMUNICATION</b>			
B1 baud-rate	2400		
B2 address	1		
B3 mode	BUS-RTU		
<b>C - OTHERS</b>			
C4 pass code	0000		
C5 tagnumber	0000000		

